TABLES

Table 1

Chronology of Site Operations and Remediation History
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
Riverside, Pennsylvania

Date	Activity
Prior to 1940	Property was farmland.
1942 to 1945	The property was leased by the Heyden Chemical Company from the United States Government. Heyden manufactured hexamine for munitions during World War II, using such chemical components as methanol, formaldehyde, and anhydrous ammonia.
1950	Merck begins site operations. Merck produced hexamine during the Korean War for a six- to nine-month period in 1952 or 1953. Merck also manufactured such pharmaceutical products as penicillin, cortisone, and niacin.
1950s to 1980	Merck operated a landfill for disposal of various plant waste materials.
Early 1980s	Elevated levels of TCE and chloroform detected in several residential wells immediately east of the Merck facility in the Riverside Borough, Pennsylvania.
May 1983	Merck entered into a Consent Order and Agreement (COA) with the PADEP to investigate and remediate the groundwater contaminant plume and to provide affected residential properties with potable water.
Mid-1980s	EPA issued a HSWA Corrective Action Permit to Merck.
1989	RCRA Facility Assessment performed by EPA.
1990	EPA requests Merck conduct RCRA Facility Investigation (RFI) to assess contamination related to current and former SWMUs and documented releases.
1990-1994	Merck performs RFI.
December 1992	COA amended to include groundwater monitoring specifications.
1992-1993	Merck constructed a three well network outside the fenceline at the East End to act as a hydraulic barrier. Operation of wells was discontinued and COA modified to only require pumping if migration is detected.
October 1994	RFI Final Report submitted.
1994-1995	Performed pre-Corrective Measures Study (CMS) studies for biodegradation, recovery well optimization, and bioventing.
1995	HSWA Permit expired.
February 1998	RFI Final Report approved by EPA.
May 1998	CMS submitted.
1998-2007	With support of EPA and the PADEP, Merck performed multiple groundwater sampling events and designed and installed elements of the proposed remedial systems.
May 1999	1999 Sitewide Groundwater Sampling.
1999 - 2001	Recovery well optimization activities performed.
July 2001	Recovery well RW-OBS-6 operation initiated.
4th Quarter 2002	CMS approved.
June 2003	Vapor Intrusion (VI) Assessment submitted to PADEP and EPA.
June 2003	Horizontal well HSR-1 installed.
July 2003	Recovery wells RW-7 and RW-8 decommissioned.
4th Quarter 2003	Initial Corrective Measures Implementation (CMI) Groundwater Monitoring (Fall 2003).
November 2003 - May 2003	Installed deep bedrock monitoring wells MW-02X, MW-32X and MW-03XX.
January 2004	Horizontal recovery well operation HSR-1 initiated.
November 2004	Recovery well RW-1 removed from service.
1st Quarter 2005	2005 CMI Groundwater Monitoring.
August 2005	Updated VI Assessment submitted to DEP and EPA.

Table 1

Chronology of Site Operations and Remediation History
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
Riverside, Pennsylvania

2nd Quarter 2006	2006 CMI Groundwater Monitoring
Date	**Activity**
11/3/2006	EPA issued an SB which described the selected remedy (Appendix A).
11/3/06 - 12/18/06	Public review and comment period for SB.
1/16/07	EPA issued a signed copy of the SB.
4/25/07	EPA issued a Final Decision and Response to Comments (FDRTC).
7/10/07	HSWA Permit Modification was issued to Merck.
8/8/07	HSWA Permit Modification becomes effective.
9/4/07	COA with PADEP terminated.
3rd Quarter 2007	2007 CMI Groundwater Monitoring.
December 2007	EPA granted Cherokee Pharmaceuticals' request that EPA transfer the permit as a result of the change in site ownership on January 1, 2008.
1/1/08	Cherokee Pharmaceuticals, LLC, purchased the site.
8/8/08	CMI Report submitted to USEPA.
4th Quarter 2008	2008 CMI Groundwater Monitoring.
10/14/2008	Landfill Construction Quality Assurance Final Report Supplement submitted to PADEP.
November 2008	Former Cottage Wells abandoned.
1/21/2009	CMI Report approved by USEPA.
2/26/09	Landfill Construction Quality Assurance Final Report Supplement approved by PADEP.
1st Quarter 2009	First Five-Year CMI Re-Evaluation submitted.
1st Quarter 2010	2010 CMI Groundwater Monitoring
June 2010	Report (Development of an Institutional Control Zone Map – A Tool to Assess Future Well Installations) submitted in support of the institutional control measure development.
September 2010	Merck Sharp & Dohme Corp. reacquires the facility as a subsidiary
2st Quarter 2011	2011 CMI Groundwater Monitoring
June 27, 2012	Cherokee Pharmaceuticals requests that EPA commence transfer of HSWA Permit to Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
3st Quarter 2012	2012 CMI Groundwater Monitoring
12/3/12	Borough of Riverside votes to approve well ordinance (institutional control)
2/4/13	Borough of Riverside adopts well ordinance (institutional control)
4st Quarter 2013	2013 CMI Groundwater Monitoring
April 2014	Second Five-Year CMI Re-Evaluation submitted.
1st Quarter 2015	2015 CMI Groundwater Monitoring
2nd Quarter 2016	2016 CMI Groundwater Monitoring
May 2017	Kotzen property purchased by Cherokee Pharmaceuticals
3rd Quarter 2017	2017 CMI Groundwater Monitoring
September 2017	Operations & Maintenance Plan updated.
4th Quarter 2018	2018 CMI Groundwater Monitoring
March 2019	Third Five-Year CMI Re-Evaluation submitted.

TABLE 2

Comparison of 2018 VOC Concentrations Detected at Monitoring Well MW-32X with Historical Data
Fourth Quarter 2018 Groundwater Monitoring Event
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

	Sample Date and Type														
Analyte Name	**3/9/2005 Bailer**	**3/9/2005 PDB**	**6/1/2006 PDB**	**8/29/2007 PDB**	**11/5/2008 PDB***	**2/4/2009 PDB****	**3/3/2010 PDB***	**5/18/2011 PDB***	**8/29/2012 PDB†**	**10/23/2013 PDB**	**3/16/15 PDB***	**5/25/16 PDB***	**8/30/17 PDB***	**10/10/18 PDB***	**1% of the Solubility Limit*****
1,2-DICHLOROETHANE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	<1	<1	<1	<5	
ACETONE	<20	<20	10 JB	20 JB	<1000	<200	< 2,000	13 JB	13 JB	<20	<20	<20	<20	3 J	miscible
ACETONITRILE	<100	<100	<100	<100	<5000	<1,000	< 10,000	<100	<100	<100	<100	<100	<100	<100	
BENZENE	<5	34	65	310	1,200	1,500	2,600	170	140	16	450	90	150	140	17,805
BROMOBENZENE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	<5	<5	<5	<5	
CARBON TETRACHLORIDE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	<1	<1	<1	<1	
CHLOROBENZENE	<5	<5	<5	3 J	<250	45 J	< 500	3 J	2 J	<5	9	1	2	2	4,900
CHLOROFORM	<5	<5	81	2,900	18,000	22,000	40,000	2,800	2,900	3 J	3,300	230	73	33	80,000
CHLOROMETHANE	<5	<5	<5	<5	<250	22 J	< 500	8	4 J	<5	11	1	0.8 J	0.4 J	61,800
CIS-1,2-DICHLOROETHENE	<5	<5	<5	1 J	<250	<50	< 500	<5	<5	<5	3	<1	0.6 J	0.6 J	
ETHANOL	<1000	<1000	<1000	<1000	<1000	<1,000	< 1,000	<1000	<1000	<1000	NA	NA	NA	NA	
ETHYL ETHER	<5	21	33	55	<250	71	< 500	9	7	<5	19	5 J	6	7	604,000
HEXANE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	<5	<5	<5	<5	
METHANOL	<1000	<1000	<1000	<1000	<1000	<1,000	< 1,000	<1000	<1000	<1000	NA	NA	NA	NA	
METHYLENE CHLORIDE	<5	<5	230	5,700	28,000	36,000	66,000	5,300	5,400	34	12,000	970	400	130	200,000
TETRACHLOROETHENE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	<1	<1	<1	<1	
TETRAHYDROFURAN	<10	<10	<10	<10	<250	<100	< 1,000	<10	<10	<10	<10	<10	<10	<10	
TOLUENE	1	7	2 J	44	260	480	630	33	22	3 J	99	13	26	18	5,324
TRANS-1,2-DICHLOROETHENE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	NA	NA	NA	NA	
TRICHLOROETHENE	<5	<5	<5	<5	<250	<50	< 500	<5	<5	<5	<1	<1	<1	<1	
VINYL CHLORIDE	<5	<5	<5	1 J	<250	<50	< 500	1 J	1 J	<5	5	0.5 J	1 J	1	27,000
Total VOC Concentration	**1**	**62**	**411**	**9,014**	**47,460**	**60,118**	**109,230**	**8,337**	**8,476**	**56**	**15,896**	**1,310.5**	**659.4**	**335.0**	

Notes:
All units are in mg/l.
PDB - indicates sample collected using passive diffusion bag that was submerged in well for approximately two weeks
Bailer - Indicates that the sample was collected without purging the well, using a dedicated disposable bailer
Shading indicates that the constituent was detected.
J indicates the value is estimated. J-qualified values are included in Total VOC calculation
B indicates that the constituent was detected in a blank at a similar concentration. B-qualified values are not included in Total VOC calculation
* Primary sample shown, duplicate sample had similar results
** Resample
*** Source of solubility limits: 25 Pa Code, Chapter 250, Appendix A, Table 5.
† Primary sample shown. Duplicate sample results were similar except for chloroform (770 mg/l)

TABLE 3

2013-2018 Groundwater Recovery Well System Operations Summary
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
Riverside, Pennsylvania

Recovery Well	December 2013 to March 2015 Total Volume Pumped (Gallons)	March 2015 to June 2016 Total Volume Pumped (Gallons)	June 2016 to September 2017 Total Volume Pumped (Gallons)	September 2017 to December 2018 Total Volume Pumped (Gallons)	Five Year Period Total Volume Pumped (gal)
RW-2	5,943,560	7,875,233	5,318,031	5,391,708	**24,528,532**
RW-4	2,084,564	2,693,408	2,329,035	2,404,246	**9,511,253**
RW-9	751,323	1,295,823	1,569,625	1,517,909	**5,134,680**
RW-1D	254,354	317,859	339,835	306,867	**1,218,915**
RW-OBS-6	12,862,407	13,404,593	12,572,746	12,378,196	**51,217,942**
HSR-1	1,343,369	1,278,457	1,535,758	2,284,441	**6,442,025**
TOTAL	**23,239,577**	**26,865,373**	**23,665,030**	**24,283,367**	**98,053,347**

TABLE 4

VOC Concentrations Detected at Landfill Vicinity Monitoring Wells Since 1999
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
Riverside, Pennsylvania

Monitoring Location	Date	1,2-Dichloroethane	Acetone	Benzene	Chlorobenzene	Chloroform	cis-1,2-Dichloroethene	Ethanol	Ethyl Ether	Tetrahydrofuran
MW-08D	5/10/99							4,750	3,147.67	
	10/27/03								1200	
	3/3/05			10	5 J				940	
	5/25/06			3 J	5				1300	
	8/23/07				5 J				1000	
	10/31/08				4 J				820	
	2/25/10				4 J				710	
	5/11/11				4				820	
	8/23/12				3 J				640	
	10/17/13				4 J				660	
	3/11/15				4				710	
	5/18/16				4				900	
	8/24/17				4				800	
	10/4/18				3				750 E	
MW-08M	5/7/99								185.53	23.66
	10/28/03								28	10
	3/4/05			0.9 J					27	7 J
	5/22/06			0.8 J					26	
	8/20/07			1 J					26	
	10/27/08			0.7 J					30	
	2/22/10			0.9 J					26	
	5/9/11			0.7					30	
	8/20/12			0.7 J					32	
	10/16/13			0.5 J					26	
MW-09D	5/6/99				307.58		3.10 J		22.38	
	10/27/03				110				11	
	3/2/05				83		2 J		9	
	5/22/06				63		2 J		12	
	8/20/07				38		3 J		12	
	10/27/08				33		3 J		14	
	2/22/10			0.6 J	190		2 J		8	
	5/9/11				160		1		6	
	8/22/12				18		2 J		10	
	10/14/13				7		2 J		11	
	3/10/15	1			5		3		14	
	5/16/16	1			16		2		10	
	8/21/17				100		1		7	
	10/3/18				51		0.8 J		7	
MW-09S	5/4/99				37.60					
	3/1/05				4 J					
	5/22/06				47					
	8/28/07				9	1 J				
	10/27/08				41				3 J	
	2/22/10				3 J					
	5/9/11					35				
	8/22/12				4 J					
	10/16/13				2 J					
	3/10/15				4				3 J	
	5/18/16									
	8/23/17									
	10/1/18				0.9 J	8			1 J	
MW-10S	5/5/99				34.85					
	10/23/03				17					
	2/28/05				8					
	5/22/06				5 J					
	8/20/07				6					
	10/27/08				4 J					
	2/22/10				4 J					
	5/9/11				6					
	8/20/12				6					
	10/14/13				4 J					
MW-19D	5/3/99			43.80	370				122	
	10/27/03			17	300				110	
	3/3/05			10	280				84	
	5/24/06			9	290				110	
	8/22/07		8 J	7	250				110	
	10/29/08		14 J	7	270				100	
	2/23/10		7 J	5 J	230				71	
	5/10/11			2	250				79	
	8/22/12		11 J	1 J	260				71	
	10/17/13				270				60	
	3/10/15				260				72	
	5/18/16				230				69	
	8/23/17				230				56	
	10/3/18		2 J		270				70	
MW-19S	5/3/99				48.80					
	10/23/03				39					
	3/1/05				4 J					
	5/22/06			3 J	180				3 J	
	8/21/07			2 J	180				4 J	
	10/29/08		11 J	5	420				7	
	2/23/10			5 J	390				5	
	5/11/11									
	8/20/12		10 J	2 J	99				3 J	
	10/16/13				88				3 J	
	3/10/15				150				4 J	
	5/17/16				110					
	8/23/17				190				2 J	
	10/3/18				3	0.2 J				
MW-20D	5/3/99				13.90					
	10/23/03				19				6	
	3/3/05				19				4 J	
	5/23/06				12				3 J	
	8/21/07				7				3 J	
	10/28/08				7				3 J	
	2/23/10				10				3 J	
	5/11/11				9				4	
	8/21/12				8				3 J	
	10/15/13				6				2 J	

Units are ug/L
Blank entries indicate that the VOC compound was not detected
Monitoring wells MW-08M, MW-10S, and MW-20D were removed from the monitoring program in 2014.
J indicates that the value is estimated because the detected amount was below the sample quantitation limit.

TABLE 5

Groundwater Recovery Well System Maintenance Summary
Third Quarter 2017 to Fourth Quarter 2018
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
Riverside, Pennsylvania

Date	Well	Well and Repair Type
October 2017	RW-1D, RW-2, RW-4, RW-9, RW-OBS-6, HSR-1	Flow indicators and totalizers calibrated.
	RW-4	Disinfection using 5.25% sodium hypochlorite bleach.
November 2017	RW-4	Clean pump and motor.
February 2018	HSR-1	Replace pump and motor; clean discharge piping between pump and cabinet.
April 2018	RW-1D, RW-2, RW-4, RW-9, RW-OBS-6, HSR-1	Flow indicators and totalizers calibrated.
	HSR-1	Replace flow meter.
July 2018	RW-2	Replace pump, motor, and motor lead; raise pump, transducer, and lower level probe setting depths.
	RW-1D	Clean pump and motor; replace pitless adaptor.
August 2018	RW-4	Replace pump and motor.
	RW-9	Clean pump and motor.
November 2018	RW-1D, RW-2, RW-4, RW-9, RW-OBS-6, HSR-1	Flow indicators and totalizers calibrated.
December 2018	RW-4	Disinfection using 5.25% sodium hypochlorite bleach.
	RW-1D	Replace control relay.

TABLE 6

CMI Monitoring Location Optimization Evaluation

Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.

Riverside, Pennsylvania

Well	Well Category	Monitoring Well Type	Proposed Status	Rationale
MW-01M	Intermediate BR MW	Plume Perimeter	Retain	Int. depth bedrock well with low detections and some variability along southern plant boundary.
MW-05S	Alluvium MW	Plume Perimeter*	Remove	MW-05S was added to the monitoring network in 2005 to improve isoconcentration map preparation. Historical review of MW-05S data suggested potential increasing chloroform trend, however maximum concentration was 28 ug/L in 2017 and decreased to 4 ug/L in 2018. Has been below MCL of 80 ug/L for TTHMs for entire CMI. No risk associated with this location to human health or environment.
MW-07S	Alluvium MW	Plume Perimeter	Retain	Concentrations appear to be declining over time, but have been variable and exceeded groundwater standards. VOC NEC in 2018 = 71 ug/l primarily due to chlorobenzene.
MW-08D	Shallow BR MW	Plume Perimeter	Remove	Three compounds detected historically (ethyl ether, chlorobenzene, and benzene). All CMI monitoring results below groundwater standards (VOC NEC = 0 ug/l) except for one benzene detection in 2005 (10 ug/l). Total VOC (mostly ethyl ether) concentrations have declined over time (currently 750 E ug/L; standard is 8,300). Landfill cover evaluation with respect to groundwater quality has revealed no discernable impacts from cover installation in 2006-2007. No risk associated with this location to human health or environment.
MW-13D	Shallow BR MW	Plume Perimeter	Retain	East End monitoring well, history of historically elevated TCE and chloroform concentrations, but concentrations recently declining. Currently an important monitoring point.
MW-16D	Shallow BR MW	Plume Perimeter	Retain	Elevated concentration (primarily chlorobenzene).
MW-16S	Alluvium MW	Plume Perimeter	Retain	Concentrations appear to be declining over time, but have been variable. No exceedence of groundwater standards since 2015.
MW-23D	Shallow BR MW	Plume Perimeter	Retain	East End Sentinel well.
MW-24D	Shallow BR MW	Plume Perimeter	Retain	East End Sentinel well.
MW-25D	Shallow BR MW	Plume Perimeter	Retain	East End Sentinel well.
MW-25M	Intermediate BR MW	Plume Perimeter	Retain	Int. Depth bedrock monitoirng point east of SWMU 1, monitoring decreasing VOC concentration over time. THF concentration exceeds groundwater standard. Ethyl ether concentrations variable, below groundwater standard.
MW-26D	Shallow BR MW	Plume Perimeter	Retain	East End Sentinel well.
MW-27D	Shallow BR MW	Plume Perimeter	Retain	East End Sentinel well
MW-29D	Shallow BR MW	Plume Perimeter	Retain	Southern perimeter well, shallow bedrock. Spatially important. No detects during CMI.
MW-30D	Shallow BR MW	Plume Perimeter	Retain	Southern perimeter well, shallow bedrock. Needed for spatial coverage. Very low chloroform concentrations detected 2013-2018 (below 10 ug/L), and below MCL (TTHMs).
MW-33D**	Shallow BR MW	Plume Perimeter	Retain	Southern perimeter well, shallow bedrock. Needed for spatial coverage.
MW-31M	Intermediate BR MW	Plume Perimeter	Retain	Southern perimeter well. Intermediate depth bedrock. Very low chloroform concentrations detected 2013-2018 (below 10 ug/L), and below MCL (TTHMs).
SW-0402	Alluvium MW (former source well)	Plume Perimeter*	Remove	SW-0402, in the alluvium aquifer in the western area of the plant was added to the monitoring network in 2005 to improve isoconcentration map preparation. No constituent detections since 2005 with the exception of two low detections of chloroform in 2008 and 2017 (below below the reporting limit at 1 and 0.8 ug/L respectively) and one detection of acetone in 2013 related to an acetone release (610,000 ug/L). Acetone has been non-detect since 2013. No risk associated with this location to human health or environment.
SW-Q01	Alluvium MW (former source well)	Plume Perimeter*	Remove	SW-Q01, in the alluvium aquifer in the western area of the plant was added to the monitoring network in 2005 to improve isoconcentration map preparation. Well associated with former remediated Spill Site Q. Chlorobenzene only constituent detected during CMI with only exceedences in 2008 and 2013 (both at 110 ug/L). No risk associated with this location to human health or environment.
Municipal Garage**	Water supply well	Plume Perimeter	Retain	Water supply well.
Southside Firehouse**	Water supply well	Plume Perimeter	Retain	Water supply well.
Riverside Elem.	Water supply well	Plume Perimeter	Retain	Water supply well.
MW-09D	Shallow BR MW	Landfill	Remove	Only exceedences during CMI have been chloroform in 2003, 2010, and 2011 (110, 190, and 160 ug/L, respectively). Landfill cover evaluation with respect to groundwater quality has revealed no discernable impacts from cover installation in 2006-2007. No risk associated with this location to human health or environment.
MW-09S	Alluvium MW	Landfill	Remove	No exceedence of groundwater standards throughout entire CMI. Landfill cover evaluation with respect to groundwater quality has revealed no discernable impacts from cover installation in 2006-2007. No risk associated with this location to human health or environment.
MW-19D	Shallow BR MW	Landfill	Retain	Decreasing/stable concentrations - chlorobenzene continues to exceed MCL.
MW-19S	Alluvium MW	Landfill	Retain	Variable chlorobenzene and low benzene concentrations - chlorobenzene exceeded MCL 2015-2017.
HSR-1	Horizontal Well	Source (SRA)	Retain	Recovery well.
SR-1	SRA MW	Source (SRA)	Retain	Alluvium well in former SRA. Variable concentrations. Useful to demonstrate future concentration shifts in SRA.
SR-3	SRA MW	Source (SRA)	Retain	Alluvium well in SRA. Elevated concentrations. Useful to demonstrate future concentration shifts in SRA.
SR-4	SRA MW	Source (SRA)	Retain	Alluvium well near western edge of former SRA. Concentrations variable over time. Useful to demonstrate future concentration shifts in SRA and long term decline in concentrations.
SR-8	SRA MW	Source (SRA)	Retain	Alluvium well near eastern edge of former SRA. Concentrations have exceeded groundwater standards, except for 2018. Useful to demonstrate future concentration shifts in SRA.
SW-0301	Alluvium MW (former source well)	Source (SRA)	Retain	Monitors southern side of alluvial aqufer contamination in former SRA. Has exhibited variable concentrations over time.
SW-0901	Alluvium MW (former source well)	Source (SRA)	Remove	SW-0901, in the alluvium aquifer west of the SRA was added to the monitoring network in 2005. Has been non-detect throughout entire CMI, except for one low detection of chloroform in 2011 (2 ug/L). No risk associated with this location to human health or environment.
MW-12S	Alluvium MW	Source (SRA)	Retain	Highest contaminant concentrations in the SRA alluvium aquifer. Well has been used to track decreasing concentration trends over time.

TABLE 6
CMI Monitoring Location Optimization Evaluation
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.
Riverside, Pennsylvania

Well	Well Category	Monitoring Well Type	Proposed Status	Rationale
MW-13S	Alluvium MW	Source (SRA)	Retain	Well has been used to track decreasing concentration trends over time in the SRA alluvium aquifer. Concentrations declining over time, except for increase in 2018.
MW-24S	Alluvium MW	Source (SRA)	Retain	Monitors eastern end of alluvial aqufer contamination in former SRA.
MW-12D	Shallow BR MW	Source (SRA)	Retain	Elevated concentrations benzene, THF, ethyl ether, some chlorobenzene.
MW-12M	Intermediate BR MW	Source (SRA)	Retain	Int. depth bedrock well with relatively low VOC concentrations. 1,2-DCA exceeds MCL, low benzene concentratons exceeded MCL in 2016 and 2018.
MW-03M	Intermediate BR MW	Source (SWMU 1)	Retain	Monitors long-term trend in Int Depth BR associated with zone of enhanced permeability in SWMU 1.
MW-02X	Deep BR MW	Source (SWMU 1)	Retain	Deep well.
MW-03X	Deep BR MW	Source (SWMU 1)	Retain	Deep well, very high concentrations, not expected to change over time.
MW-32X	Deep BR MW	Source (SWMU 1)	Retain	Deep well.
MW-03XX	Deep BR MW	Source (SWMU 1)	Retain	Deep well.
RW-01	SWMU 1 Recovery Well	Source (SWMU 1)	Retain	Collapsed former recovery well in middle of plant. Data marginally useful. Variable concentrations over time. Former recovery well associated with SWMU 1.
RW-02	SWMU 1 Recovery Well	Source (SWMU 1)	Retain	Recovery well.
RW-OBS-06	SWMU 1 Recovery Well	Source (SWMU 1)	Retain	Recovery well.
RW-01D	SWMU 2 Recovery Well	Source (SWMU 2)	Retain	Recovery well.
RW-04	SWMU 2 Recovery Well	Source (SWMU 2)	Retain	Recovery well.
RW-09	SWMU 2 Recovery Well	Source (SWMU 2)	Retain	Recovery well.

Notes:
* Well originally proposed to improve isoconcentration map preparation.
** Added to CMI monitoring program during May 2011

TABLE 7

Groundwater COPC List
Fourth Quarter 2018 CMI Groundwater Monitoring Event
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania

Volatile Organic Constituents
Acetone
Acetonitrile
Benzene*
Bromobenzene
Carbon tetrachloride
Chlorobenzene*
Chloroform*
cis-1,2-Dichloroethene*
1,2-Dichloroethane*
Ethyl ether*
Hexane
Methyl chloride
Methylene chloride*
Tetrachloroethene
Tetrahydrofuran
Toluene*
Trichloroethene*
Vinyl Chloride*

* indicates constituent requested by PADEP in October 2002 correspondence

TABLE 8

Summary of Review of RFI Human Health Risk Assessment (HHRA)
Cherokee Pharmaceuticals, LLC, Riverside, Pennsylvania

RFI HHRA Table or Appendix	RFI HHRA Exposure Scenario	Result of Review
3-2	On-site Soils	The screening criteria (EPA Regional Screening Level [RSL] for residential soil) for most constituents have changed since 2014, as shown on Table 3-2, but none of the changes resulted in the identification of new consituents of interest (COIs). As noted in 2014 review, trichloroethene exceeded the RSL (currently 0.94 mg/kg). The updated RSL incorporates a mutagenic endpoint that is specific to child exposure. Because there are no children exposed at the site, the residential screening level is deemed over-conservative. The maximum concentration (1.5 mg/kg) is lower than the EPA industrial soil RSL for trichloroethene (TCE; 6.0 mg/kg), which is more appropriate for this setting. Therefore, no changes to the risk assessment for soils are noted.
3-3	Seeps and Springs	Screening criteria (EPA tapwater RSL and National Recommended Water Quality Criteria [NRWQC] for Human Health for the consumption of water and organism) for most constituents changed since 2014, but none of the changes resulted in the identification of new COIs. Trichloroethene was selected as a new COI during the 2014 review due to a change in the RSL (for tapwater, currently 0.00049 mg/L) and ethylbenzene was identified as a new COI in the 2009 review due to a change in the RSL (currently 0.0015 mg/L). Also in the 2009 review, it was determined that ethyl ether would no longer be a COI because it is below the revised screening criterion. Since the calculated risks are very low for this pathway (maximum of 3E-07), the additional compounds should not change results significantly, particularly since the exposure pathway evaluated (recreational youth wading in area adjacent to site and during low-flow conditions) is extremely unlikely as well. Furthermore, exposure concentrations are likely reduced due to the implementation of the remedy in the former SRA.
3-4	River Water	Although there were many changes to the screening criteria since the 2014 review; there are no changes in the identification of COIs. One COI (chlorobenzene) was previously removed as a COI due to a change in the screening criterion. Since overall risks were very low (max 7E-08), any changes are expected to be minimal. Furthermore, exposure concentrations are likely reduced due to the implementation of the remedy in the former SRA.
3-5	Sediment	No change to the risk assessment as no constituents exceeded criteria (either before or now).
3-6	West End Residents	This exposure pathway has now been eliminated as no residences are located on the West End of the site. Therefore, HHRA Table 3-6 was not updated.
3-7	East End Residents	Monitoring of the "sentinel wells" (i.e., monitoring wells MW-23D through MW-27D) over time has continued to demonstrate that the recovery wells are effective and groundwater users south of the site are protected from

		groundwater contaminants exceeding drinking water standards. The only VOC typically detected in sentinel well samples is chloroform in MW-26D at very low concentrations (below 1 µg/L) that are approximately two orders of magnitude below the EPA Maximum Contaminant Level (MCL; 80 µg/L) for total trihalomethanes (TTHM). Chloroform, tetrachloroethene (PCE), and TCE were detected in the 2015 sample from the Municipal Garage well and associated duplicate sample at concentrations (0.2 J µg/L for each compound) below the respective laboratory LOQs and MCLs. These results are below (or slightly below) the current EPA RSLs for tapwater use: chloroform (0.22 µg/L), PCE (11 µg/L), and TCE (0.49 µg/L). The Municipal Garage employees reportedly don't use the well as a drinking water supply, therefore, the screening levels are considered conservative. Acetone was detected at low concentration in the October 2018 Southside Firehouse (4.6 J µg/L) sample, which is considered suspect. Acetone is a typical laboratory contaminant that has not been previously detected in samples collected at this location (nor has any other constituent). This result is well below the EPA RSL (14,000 µg/L). Additionally, acetone was detected in a trip blank that, although not directly associated with the Firehouse sample, was submitted to the laboratory at the same time. The Firehouse well was resampled on November 1, 2018, and acetone was not detected. Chloroform was detected at very low concentrations in both the primary and duplicate samples (0.1 JB to 0.2 JB µg/L) comprising the second sample set. These results were below the reporting limit (0.5 µg/L) and chloroform was also detected in the associated field blank at a higher concentration (1 µg/L). Therefore, the well samples were determined to result from blank contamination and are considered non-detected. In summary, risks are expected to be acceptable and HHRA Table 3-7 was not updated.
Appendix A	Hypothetical Future Resident	Future resident (on-site) assessment was not updated as this pathway is not relevant due to site deed restrictions. If at any time in the future, residences are considered for the Cherokee property then a complete risk assessment will be performed per the relevant guidance at that time.

Note: November 2018 RSLs based on TR=1E-06, HQ=1.

FIGURES

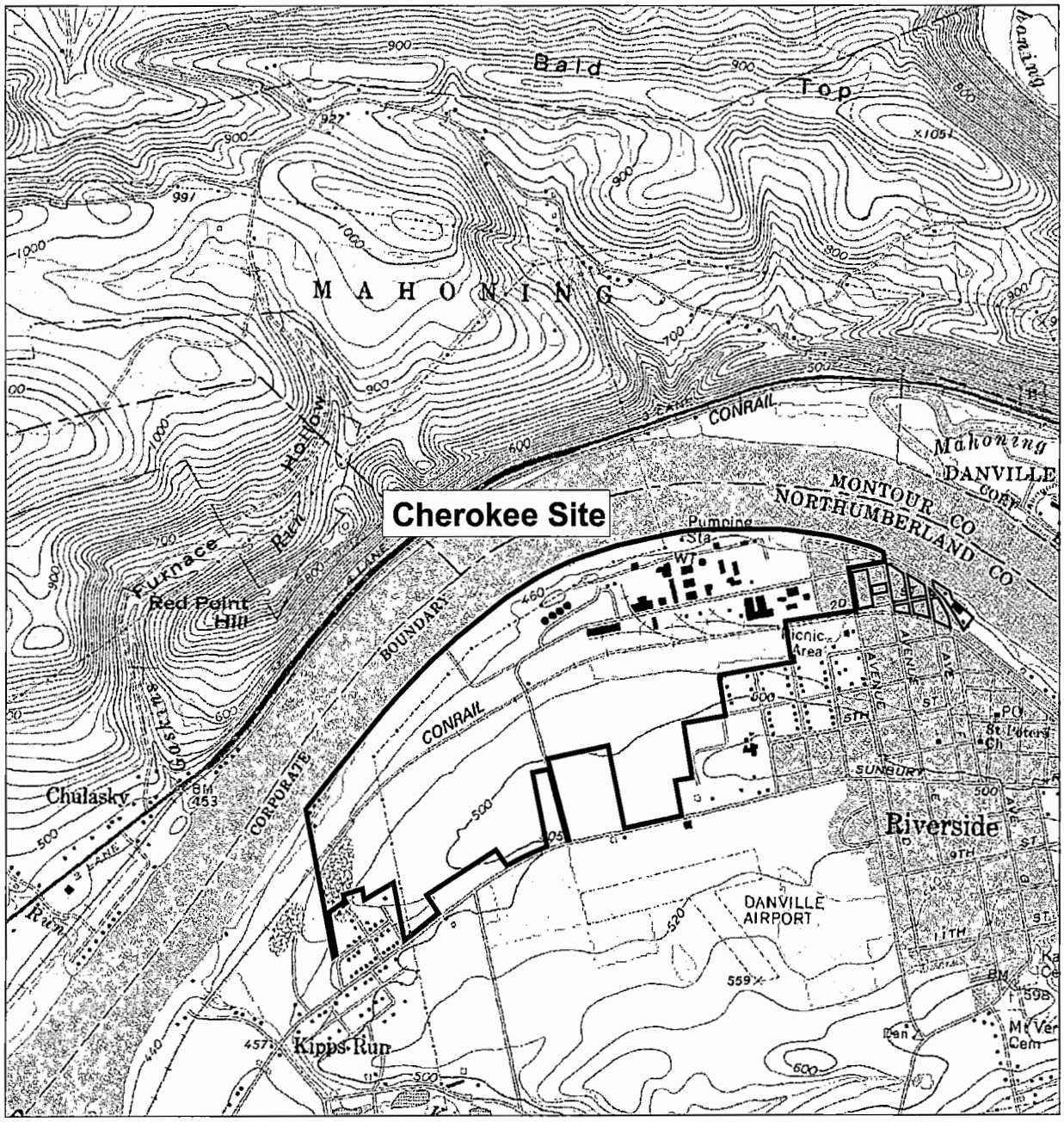
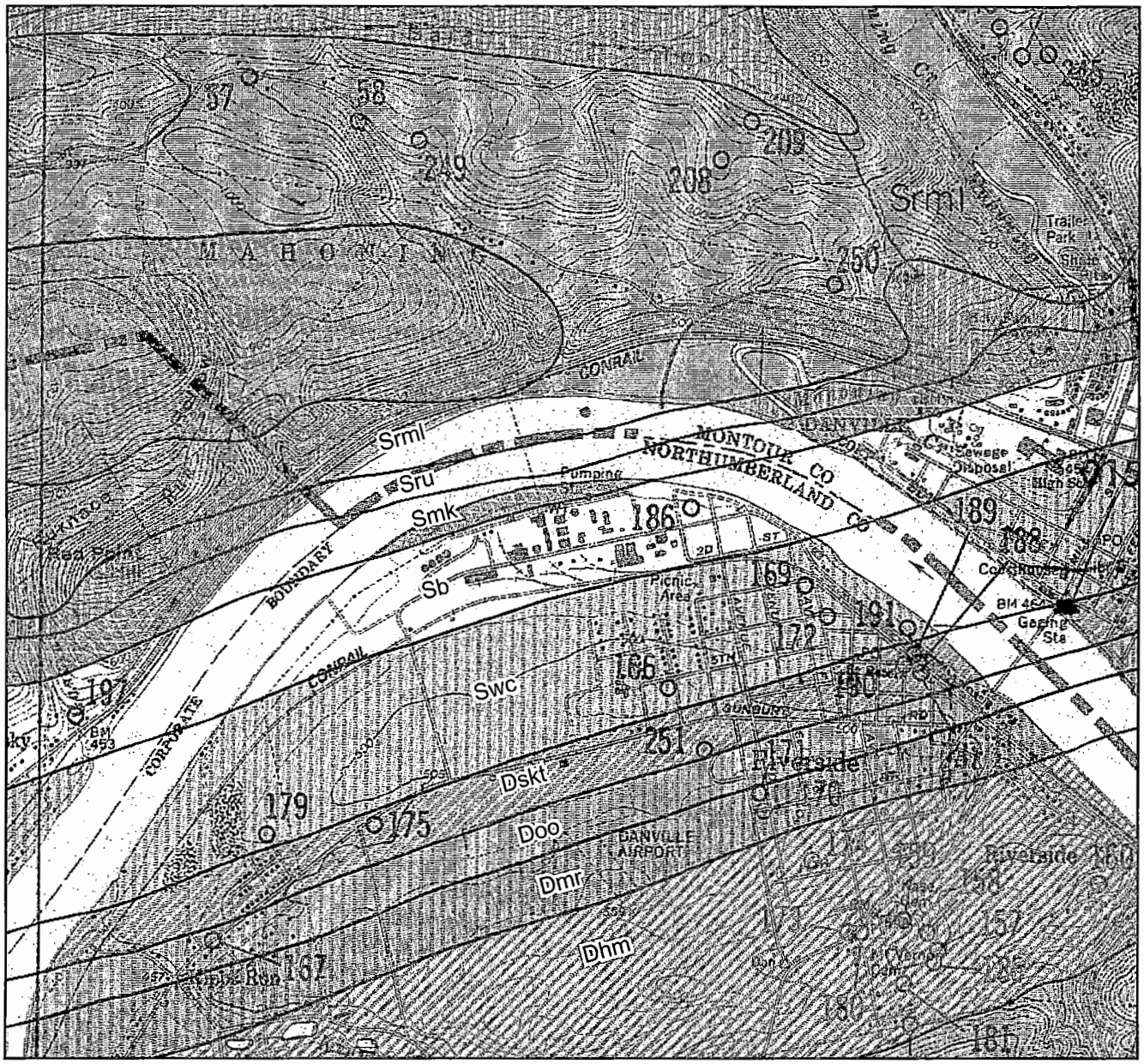


FIGURE 1

Site Location Map
(from USGS Riverside, Pennsylvania quadrangle),
Cherokee Pharmaceuticals, LLC,
A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania



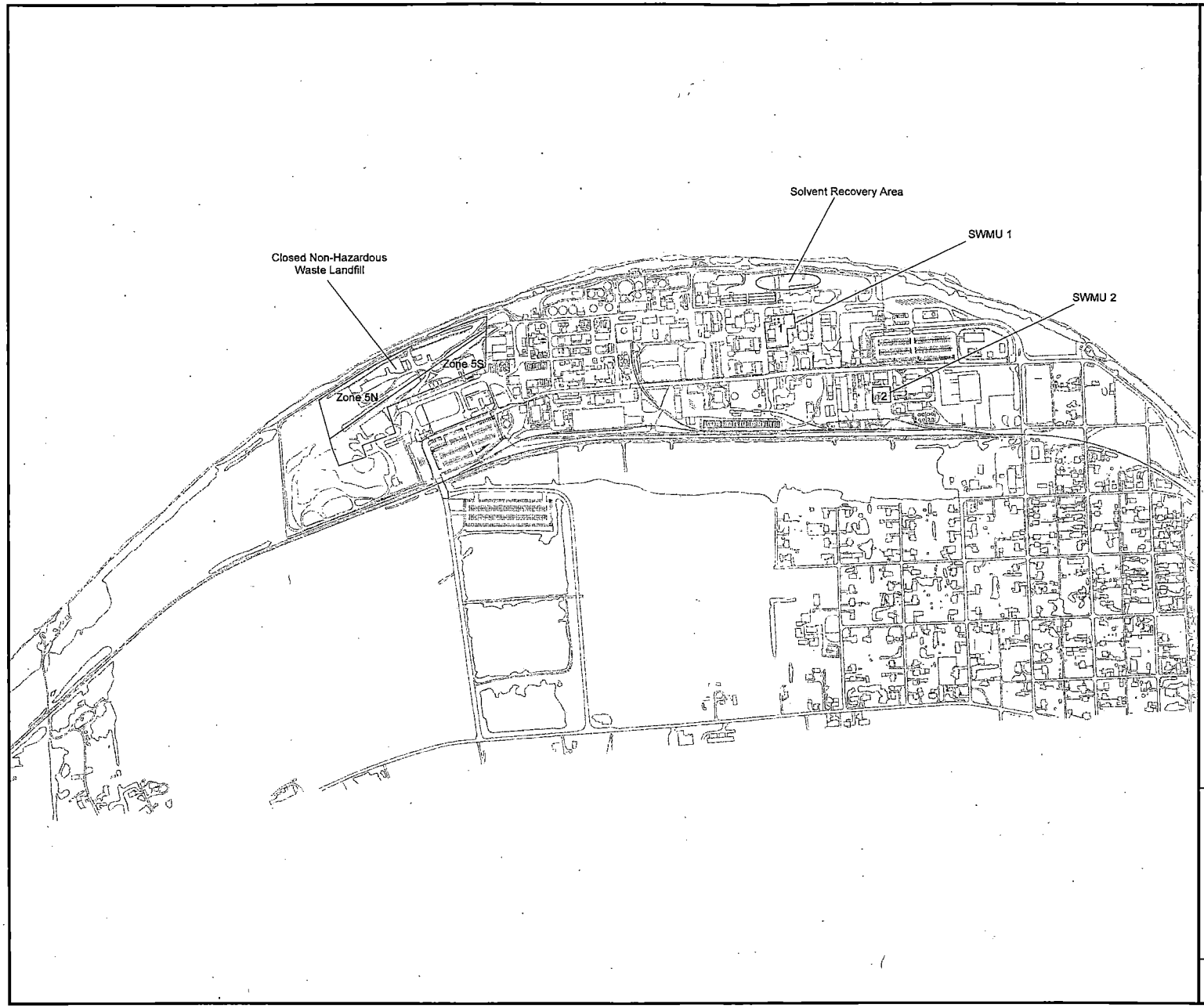
LEGEND

Srml	Rose Hill Formation, Middle and Lower Members
Sru	Rose Hill Formation, Upper Member
Smk	Mifflintown and Keefer Formations, Undivided
Sb	Bloomsburg Formation
Swc	Wills Creek Formation
Dskt	Keyser and Tonoloway Formations, Undivided
Doo	Onondaga and Old Port Formations, Undivided
Dmr	Marcellus Formation
Dhm	Harrell and Mahantango Formations, Undivided

FIGURE 2
Geologic Map (after Williams and Eckhardt, 1987)
Cherokee Pharmaceuticals, LLC,
A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania

HATCH

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\201903_CMI\Figure 2.fh9; March 15, 2019



N

True North

LEGEND

Solid Waste Management Units 1 and 2 (Former Underground Storage Tank Farms), Solvent Recovery Area, and Landfill Zone 5

700 350 0 700

Feet

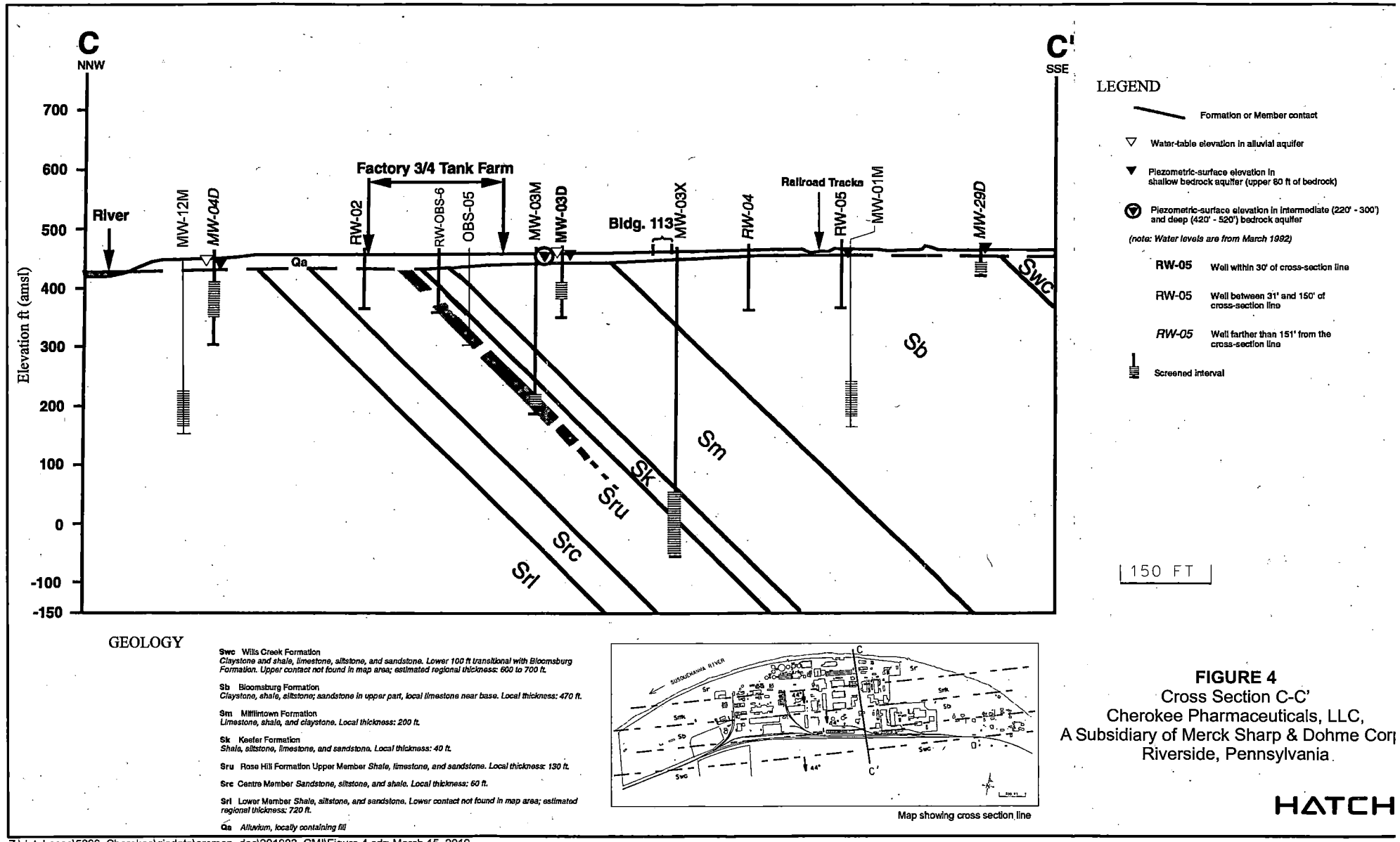
FIGURE 3

CMI Remedy Locations

Cherokee Pharmaceuticals LLC,
A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania

HATCH

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\201903_CMI\Figure 3.mxd; March 15, 2018=9



GEOLOGY

Swc Wills Creek Formation
Claystone and shale, limestone, siltstone, and sandstone. Lower 100 ft transitional with Bloomsburg Formation. Upper contact not found in map area; estimated regional thickness: 600 to 700 ft.

Sb Bloomsburg Formation
Claystone, shale, siltstone; sandstone in upper part, local limestone near base. Local thickness: 470 ft.

Sm Mifflintown Formation
Limestone, shale, and claystone. Local thickness: 200 ft.

Sk Keefer Formation
Shale, siltstone, limestone, and sandstone. Local thickness: 40 ft.

Sru Rose Hill Formation Upper Member *Shale, limestone, and sandstone. Local thickness: 130 ft.*

Src Centre Member *Sandstone, siltstone, and shale. Local thickness: 60 ft.*

Srl Lower Member *Shale, siltstone, and sandstone. Lower contact not found in map area; estimated regional thickness: 720 ft.*

Qa *Alluvium, locally containing fill*

Map showing cross section line

FIGURE 4
Cross Section C-C'
Cherokee Pharmaceuticals, LLC,
A Subsidiary of Merck Sharp & Dohme Corp
Riverside, Pennsylvania

HATCH

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\201903_CMI\Figure 4.cdr; March 15, 2019

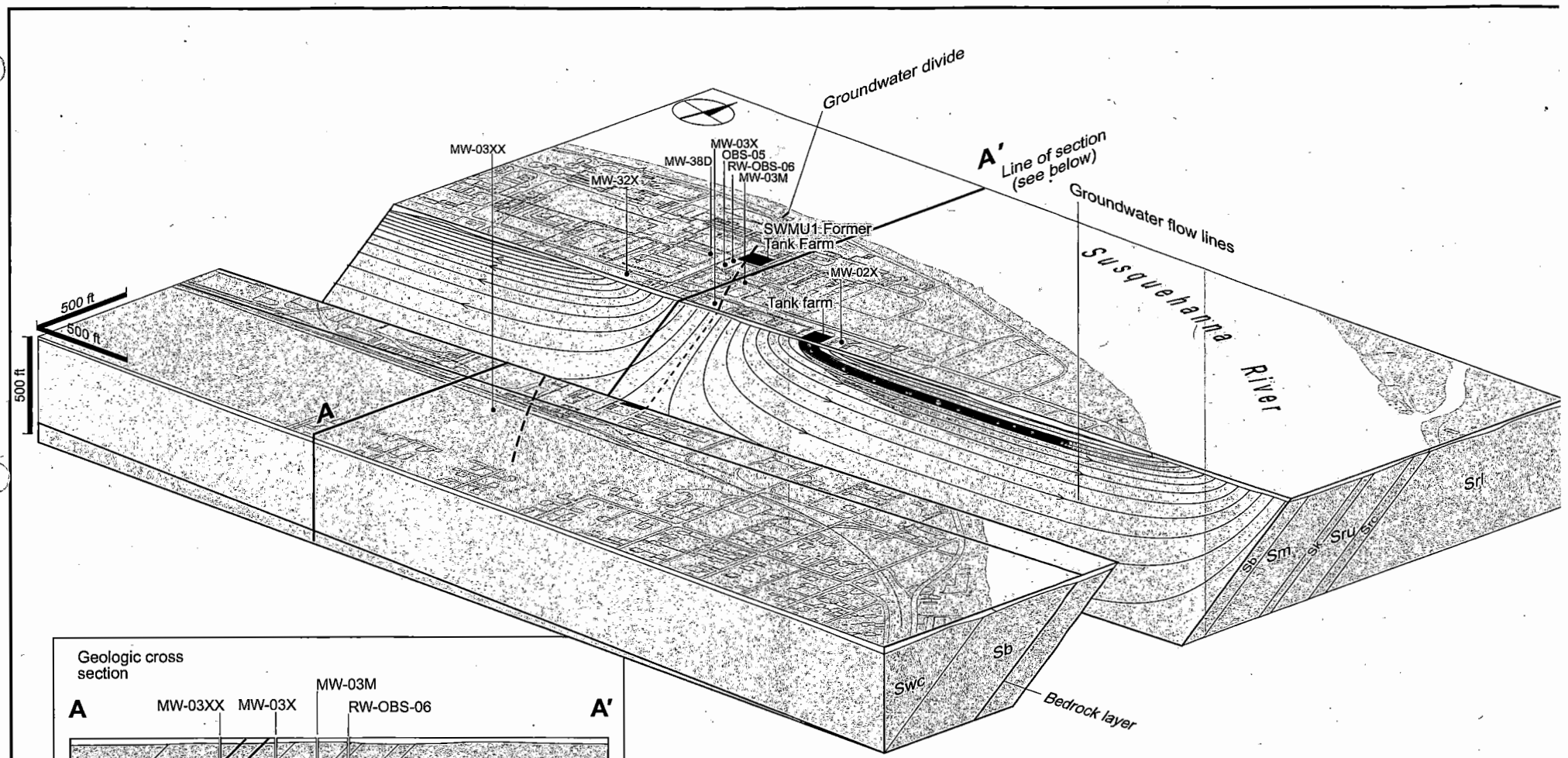
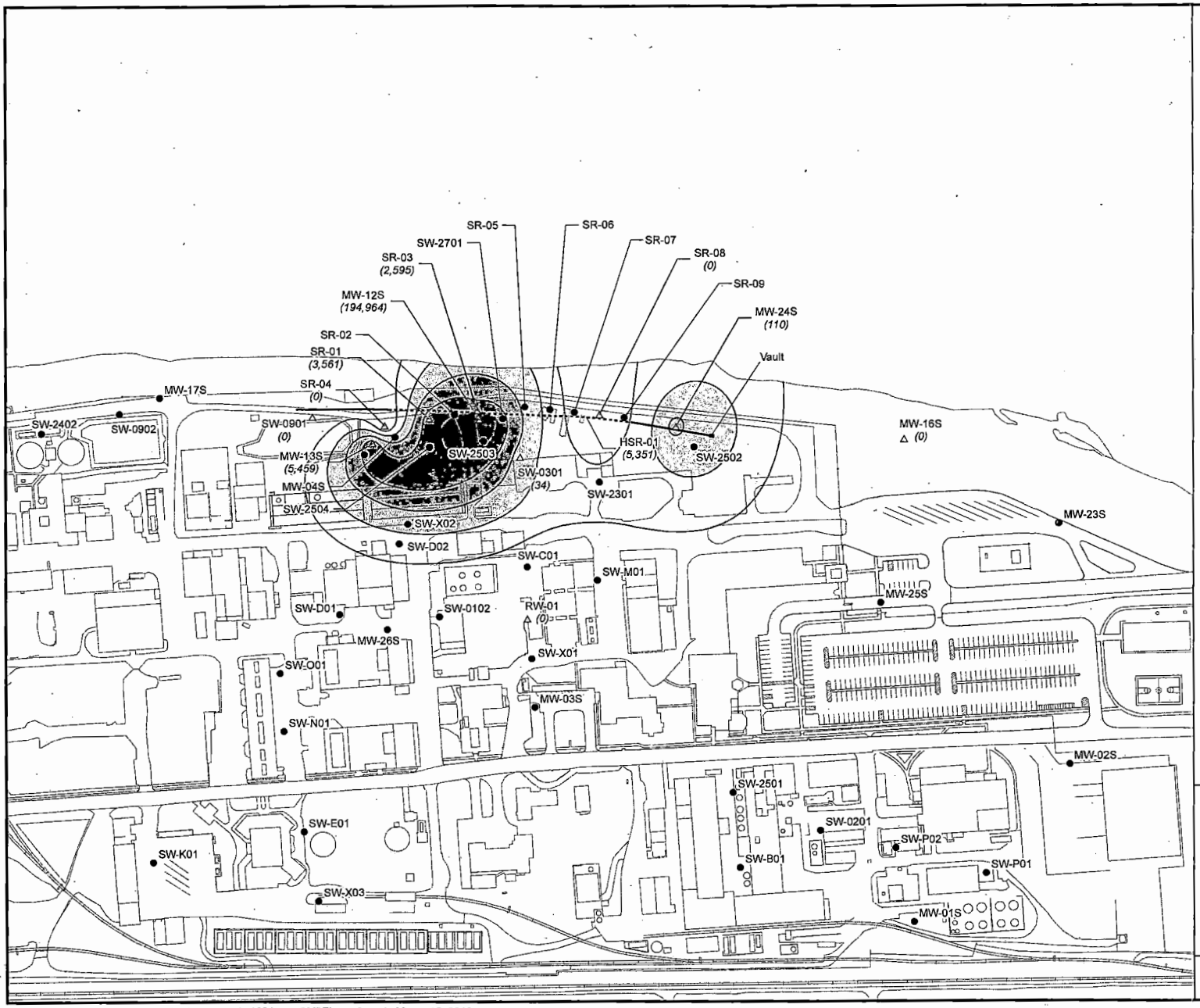


FIGURE 5
Conceptual block diagram of the Cherokee Site showing flow of groundwater and contamination within layers of bedrock (shown schematically for the purpose of illustration), Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\201903_CM\Figure 5.fh9; March 15, 2019



N
W E
S

LEGEND

- Alluvium Monitoring Well Locations
- CMI Alluvium Monitoring Wells
- HSR-1 Screen Interval
- HSR-1 Casing Interval
- Isoconcentration Contour (ug/L)

Total VOC Concentrations (ug/L)

- 1-9.99
- 10-99.99
- 100-999.9
- 1000-9999
- 10,000-99,999
- >100,000

Notes:

Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

Isoconcentration contours are based on results from the October 2018 CMI groundwater monitoring well sampling.

0 100 200 400
Feet

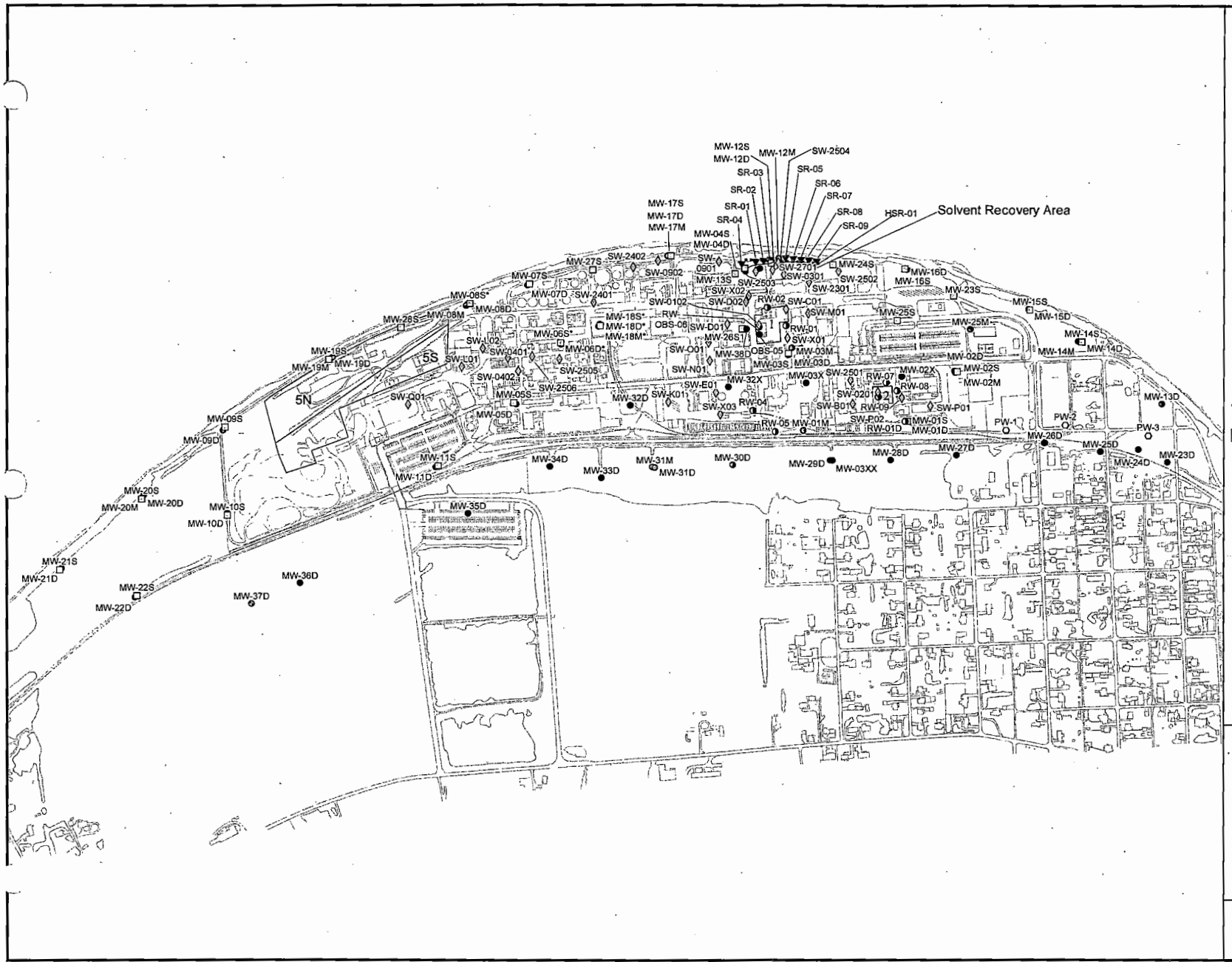
FIGURE 6

Isoconcentration Contours for Total Net Exceedance Concentrations in the Alluvial Aquifer in the Vicinity of the Solvent Recovery Area, Fourth Quarter 20

Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\201903_CMI\Figure 6.mxd; March 15, 2019



True North

LEGEND

Well Type

- Alluvium Monitoring Well
- Alluvium Source Well
- Shallow Bedrock Monitoring Well
- Intermediate Depth Bedrock Monitorin
- Deep Bedrock Monitoring Well
- Offsite Pumping Well
- SWMU 1 or 2 Recovery Well
- Solvent Recovery Area Wells
- HSR-1 Screened Interval
- Solid Waste Management Units 1 and Solvent Recovery Area, and Landfill Z

Notes:

(*) Denotes abandoned or damaged well. MW-08S needs to be re-surveyed.

Due to the scale at which this map is displayed, some well symbols may be difficult to see due to overlap from adjacent wells.

600 300 0 600

Feet

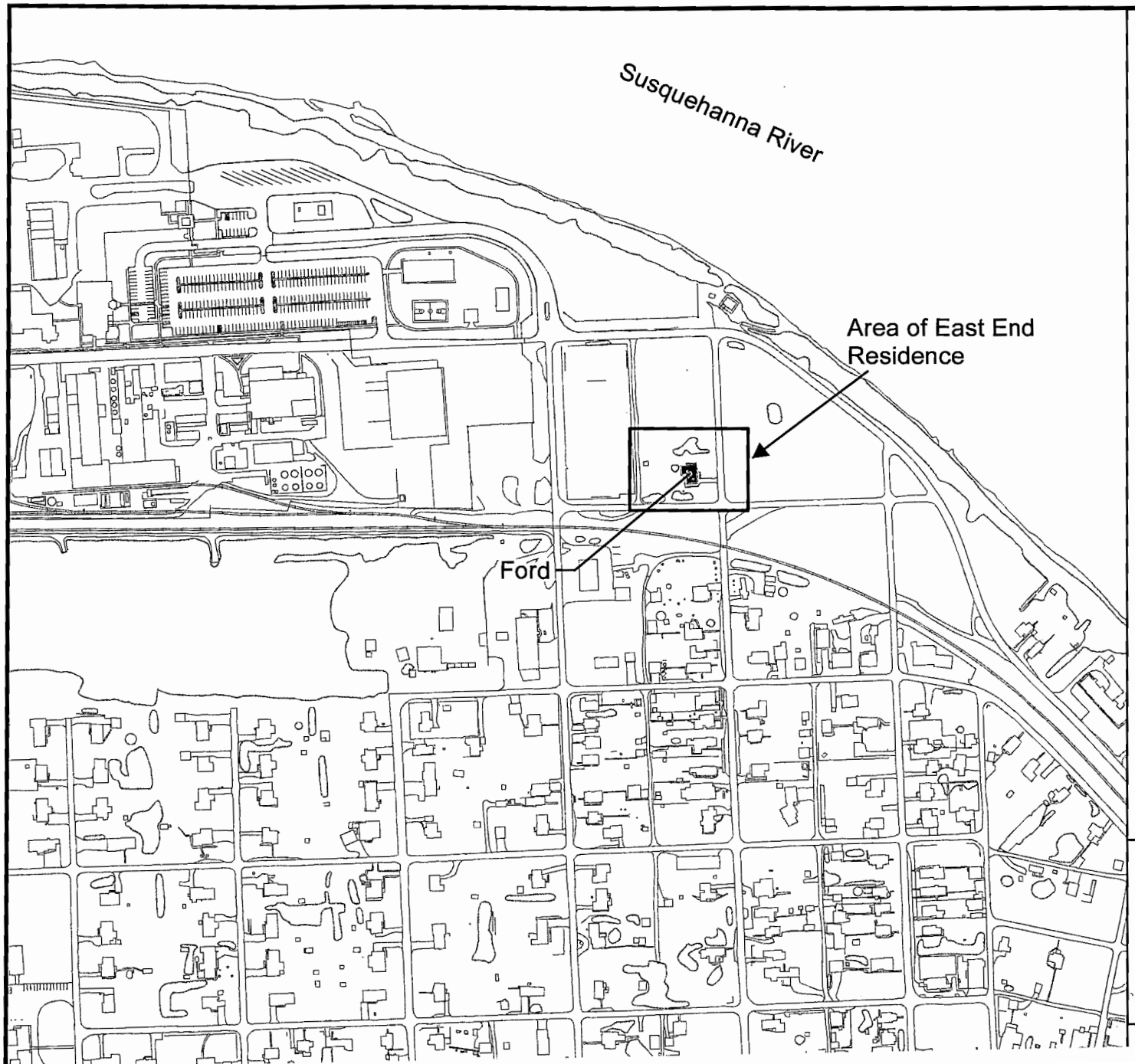
FIGURE 7

Site Monitoring and Recovery Well Network

Cherokee Pharmaceuticals LLC,
A Subsidiary of Merck Sharp & Dohme Corp
Riverside, Pennsylvania

HATCH

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\201903_CMI\Figure 7.mxd; March 15, 2019



N
W E
S

Notes:

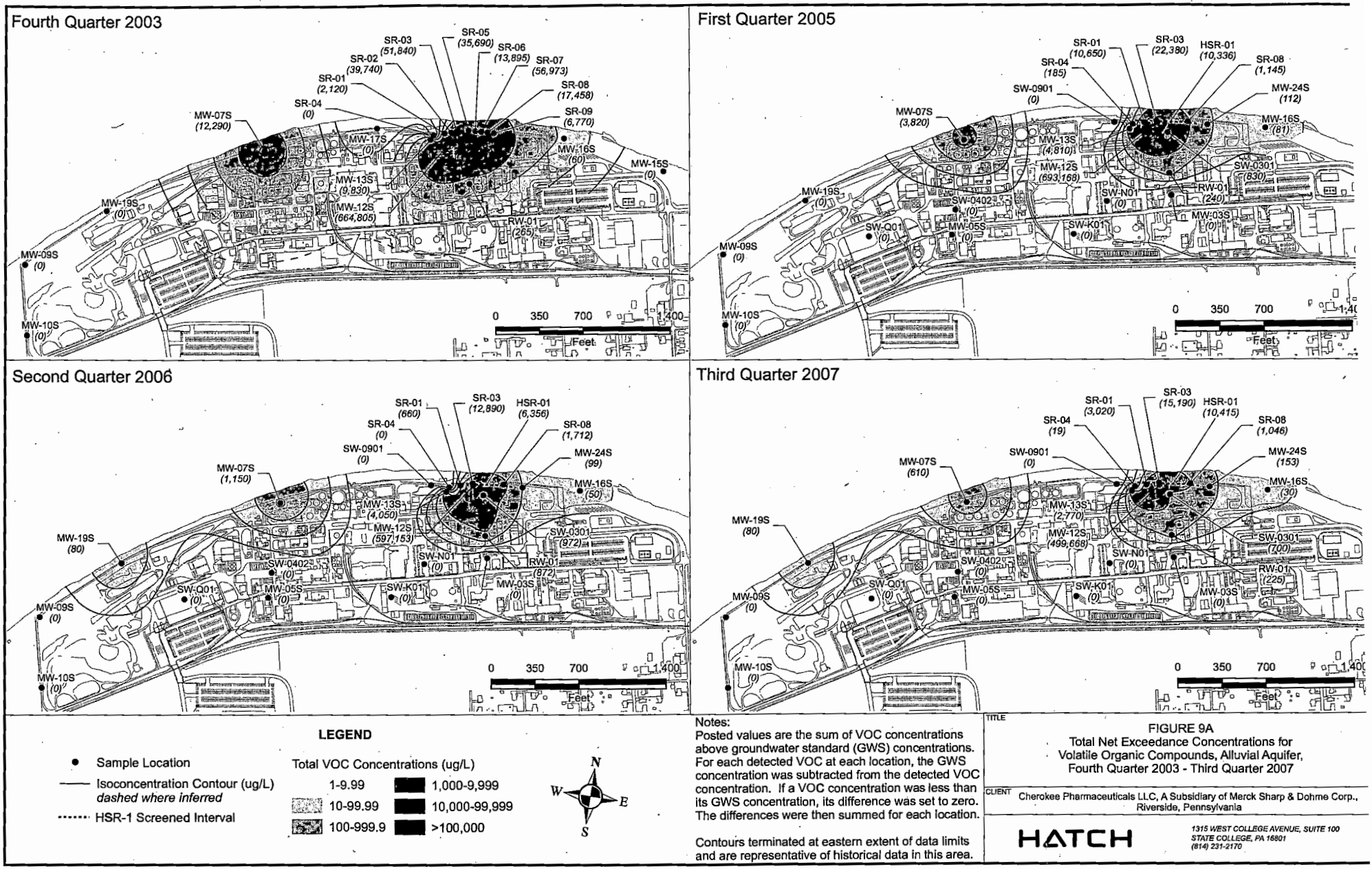
1. Kotzen property was purchased by Merck in 2017 and structures were subsequently demolished.

0 200 400 800
Feet

FIGURE 8

Residential Potable Water Supplied by Cherokee Plant

Cherokee Pharmaceuticals LLC,
A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania



Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

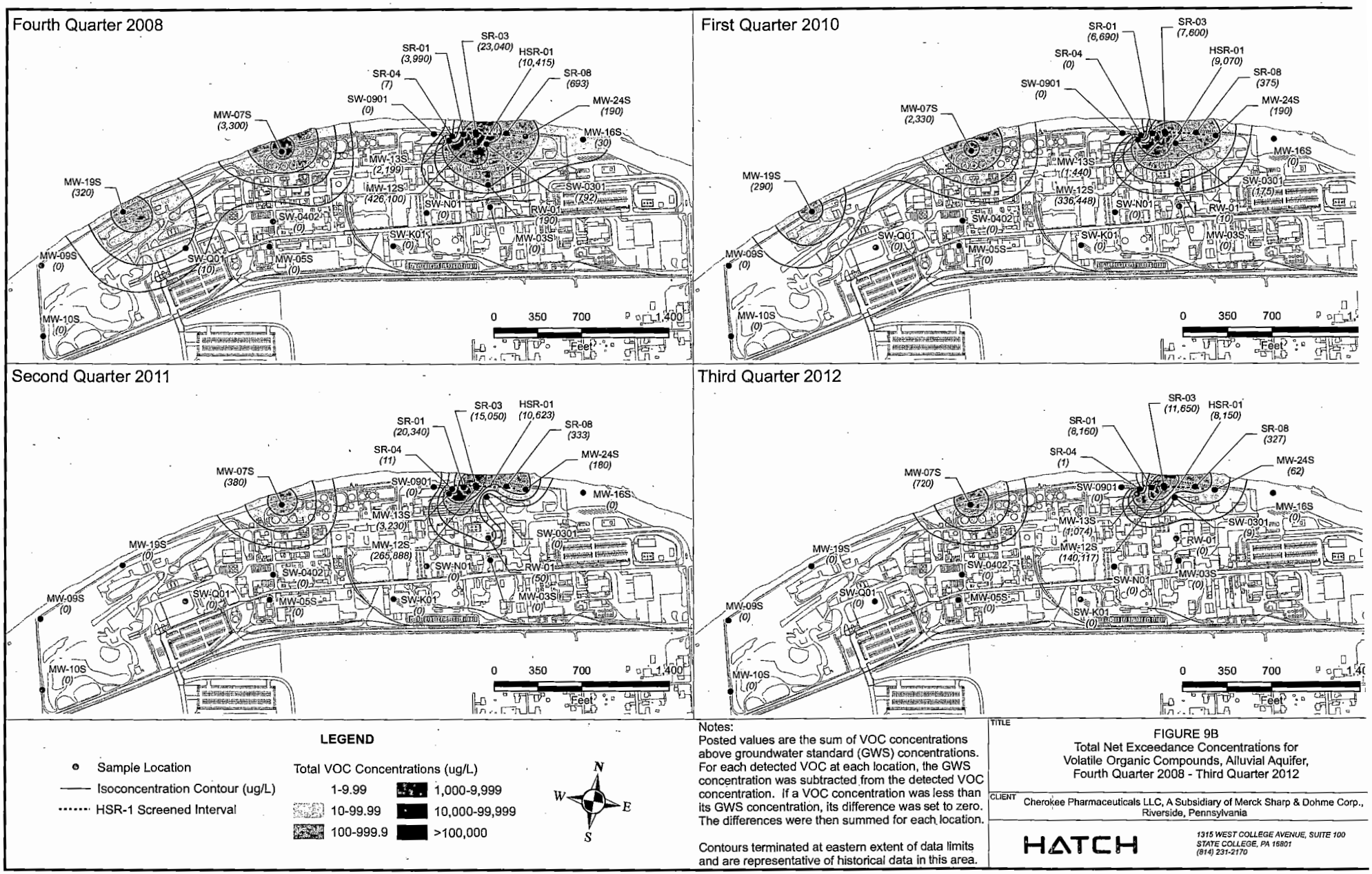
Contours terminated at eastern extent of data limits and are representative of historical data in this area.

TITLE
FIGURE 9A
Total Net Exceedance Concentrations for Volatile Organic Compounds, Alluvial Aquifer, Fourth Quarter 2003 - Third Quarter 2007

CLIENT
Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\2018\12a-H-356818-001.cdr



Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

Contours terminated at eastern extent of data limits and are representative of historical data in this area.

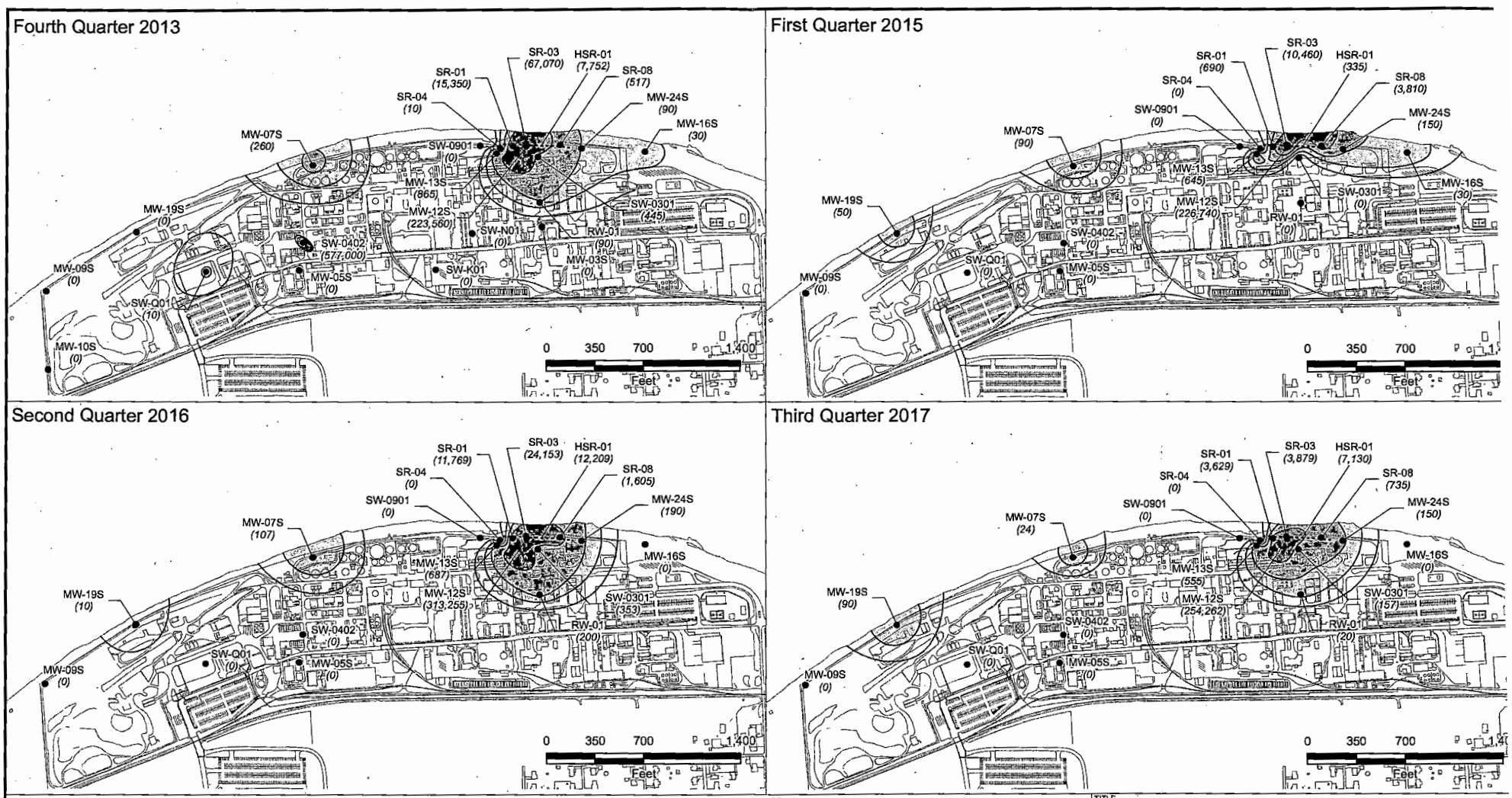
TITLE

FIGURE 9B
Total Net Exceedance Concentrations for Volatile Organic Compounds, Alluvial Aquifer, Fourth Quarter 2008 - Third Quarter 2012

CLIENT Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\2018\f12b-H-356618-001.cdr



Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

Contours terminated at eastern extent of data limits and are representative of historical data in this area.

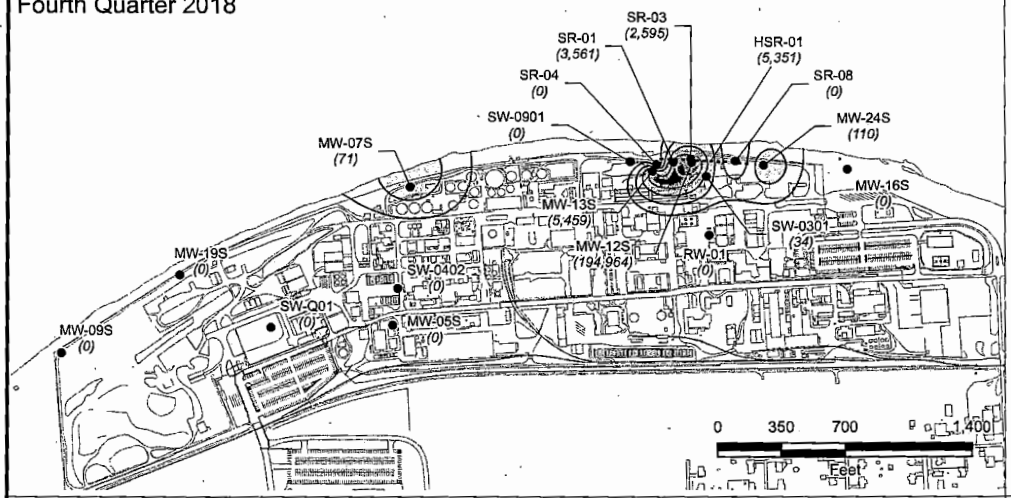
TITLE
FIGURE 9C
Total Net Exceedance Concentrations for Volatile Organic Compounds, Alluvial Aquifer, Fourth Quarter 2013 - Third Quarter 2017

CLIENT Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5626_Cherokee\gisdata\arcmap_doc\2016\f12c-H-356618-001.cdr

Fourth Quarter 2018



First Quarter 2020

Second Quarter 2021

Third Quarter 2022

LEGEND

- Sample Location
- Isoconcentration Contour (ug/L)
- HSR-1 Screened Interval

Total VOC Concentrations (ug/L)

1-9.99	1,000-9,999
10-99.99	10,000-99,999
100-999.9	>100,000

N
W E
S

Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

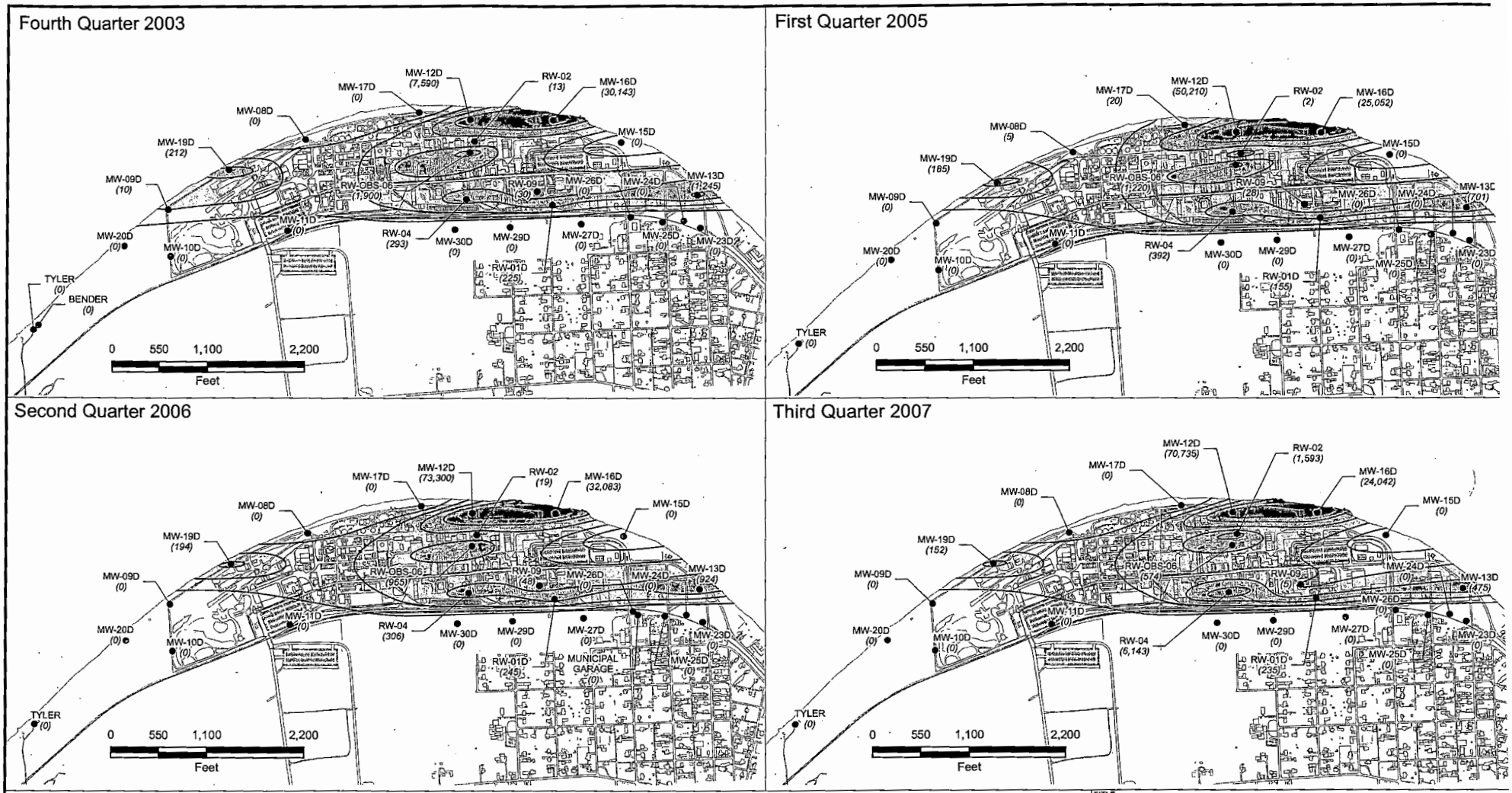
Contours terminated at eastern extent of data limits and are representative of historical data in this area.

TITLE
FIGURE 9D
Total Net Exceedance Concentrations for Volatile Organic Compounds, Alluvial Aquifer, Fourth Quarter 2018

CLIENT Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5826_Cherokee\gisdata\arcmap_dcc\2018\f12d-H-356618-001.cdr



Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

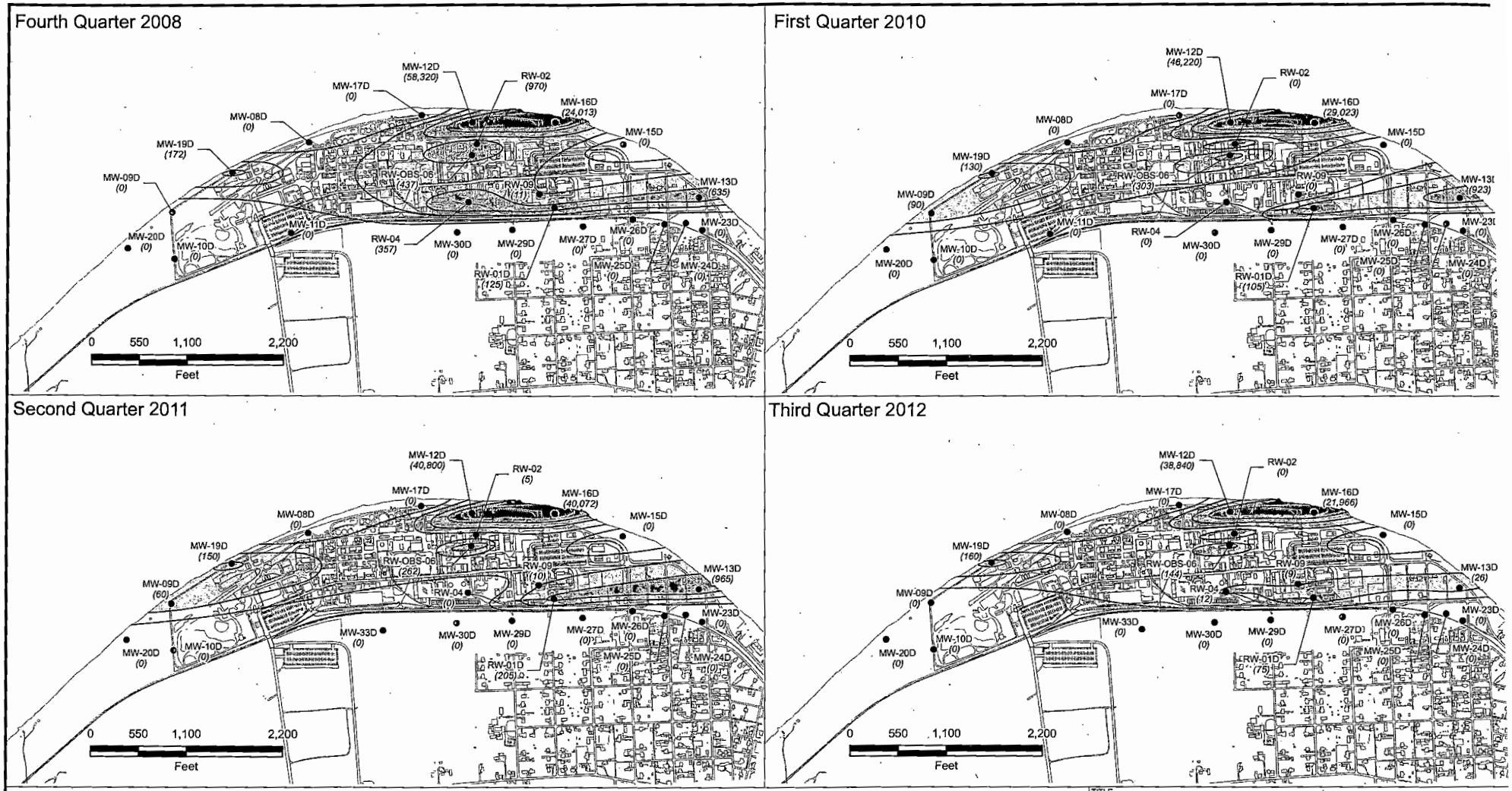
TITLE

FIGURE 10A
Total Net Exceedance Concentrations
for Volatile Organic Compounds, Shallow Bedrock Aquifer,
Fourth Quarter 2003 - Third Quarter 2007

CLIENT Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\2018\f13a-H-356618-001.cdr



LEGEND

- Sample Location
- Isoconcentration Contour (ug/L)

Total VOC Concentrations (ug/L)

- 1-9.99
- 10-99.99
- 100-999.9
- 1,000-9,999
- 10,000-99,999

N W E S

Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

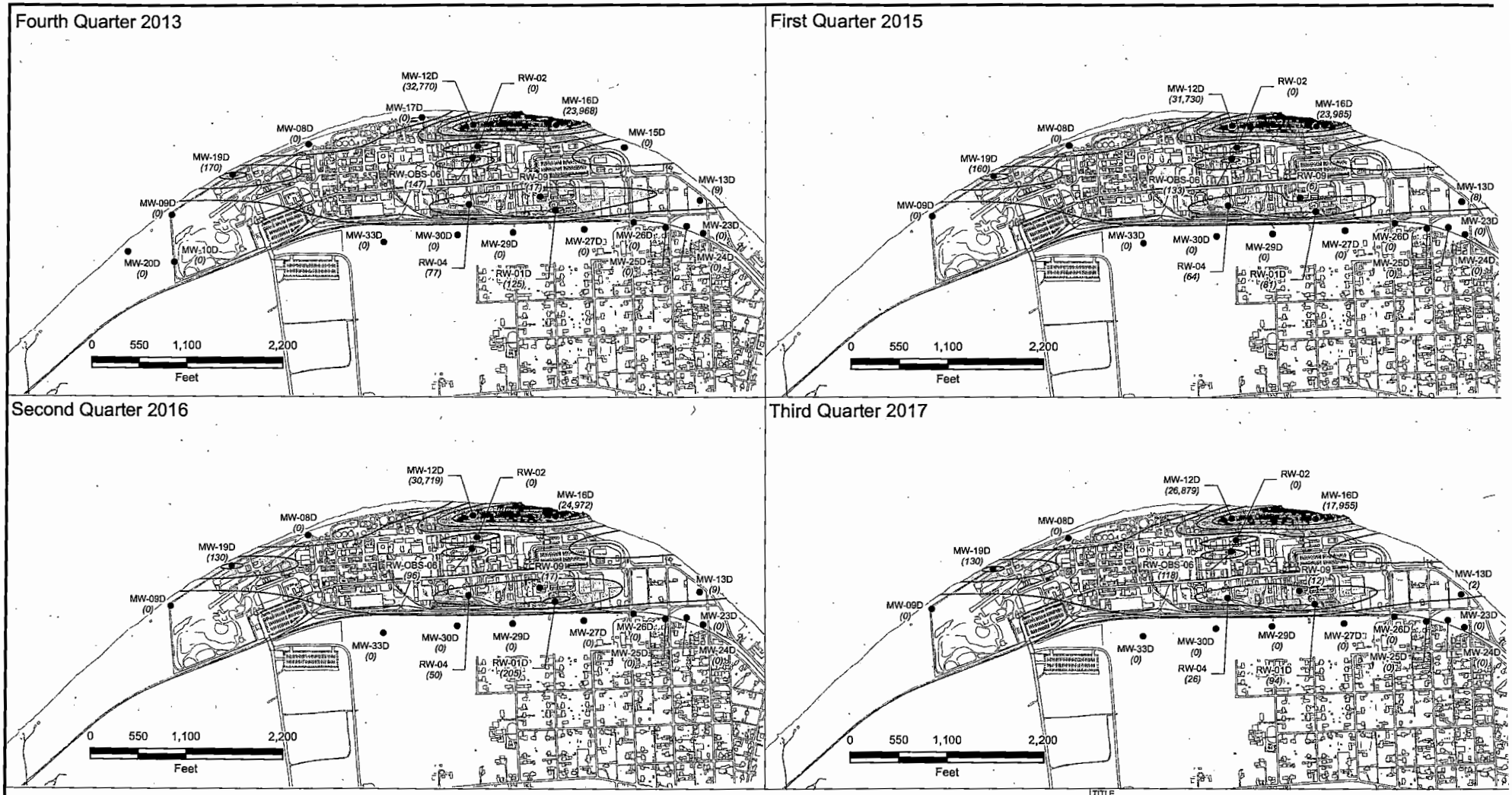
TITLE

FIGURE 10B
Total Net Exceedance Concentrations
for Volatile Organic Compounds, Shallow Bedrock Aquifer,
Fourth Quarter 2008 - Third Quarter 2012

CLIENT Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5826_Cherokee\gisdata\arcmap_doc\2018\13b-H-356618-001.cdr



Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

TITLE
FIGURE 10C
Total Net Exceedance Concentrations
for Volatile Organic Compounds, Shallow Bedrock Aquifer,
Fourth Quarter 2013 - Third Quarter 2017

CLIENT
Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1316 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

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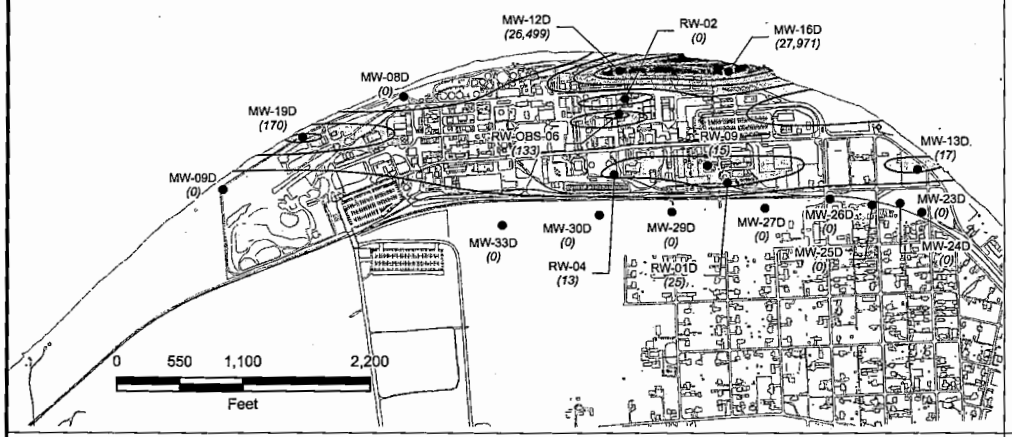
Fourth Quarter 2018



First Quarter 2020

Second Quarter 2021

Third Quarter 2022

LEGEND

- Sample Location
- Isoconcentration Contour (ug/L)

Total VOC Concentrations (ug/L)

- 1-9.99
- 10-99.99
- 100-999.9
- 1,000-9,999
- 10,000-99,999

N
W E
S

Notes:
Posted values are the sum of VOC concentrations above groundwater standard (GWS) concentrations. For each detected VOC at each location, the GWS concentration was subtracted from the detected VOC concentration. If a VOC concentration was less than its GWS concentration, its difference was set to zero. The differences were then summed for each location.

TITLE
FIGURE 10D
Total Net Exceedance Concentrations
for Volatile Organic Compounds, Shallow Bedrock Aquifer,
Fourth Quarter 2018

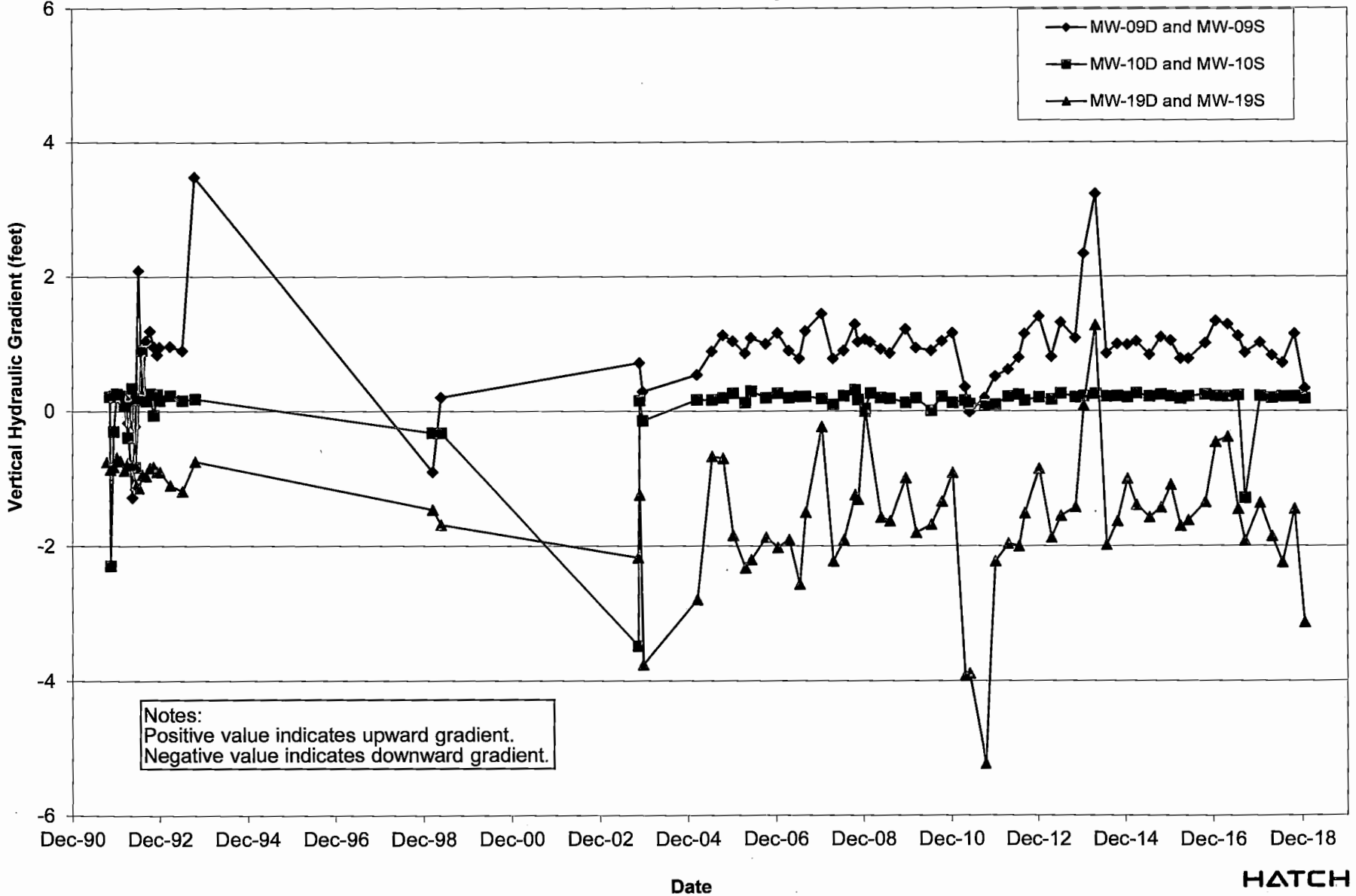
CLIENT
Cherokee Pharmaceuticals LLC, A Subsidiary of Merck Sharp & Dohme Corp., Riverside, Pennsylvania

HATCH
1315 WEST COLLEGE AVENUE, SUITE 100
STATE COLLEGE, PA 16801
(814) 231-2170

Z:\databases\5926_Cherokee\gisdata\arcmap_doc\2018\f13d-H-356618-001.cdr

Figure 11

Difference in Water level Elevations between Alluvium and
Shallow Bedrock Well Pairs in the Vicinity of the West End Landfill
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania



HATCH

APPENDICES
APPENDIX A

Regulatory Correspondence

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

September 8, 2014

Jay Steely
Safety & Environmental Specialist
Cherokee Pharmaceuticals, LLC (Cherokee)
100 Ave. C
P.O. Box 367
Riverside, PA 17868

RE: Cherokee Corrective Measures Implementation (CMI) Five Year Re-Evaluation Report
October 2008-October 2013

Dear Mr. Steely:

The United States Environmental Protection Agency (USEPA) and the Pennsylvania Department of Environmental Protection Agency (PADEP) approve the aforementioned report. The Agencies concur with Cherokee's proposed modifications to the CMI groundwater sampling program with comments relating to the removal of the proposed11 monitoring wells. In the future if Cherokee proposes to shut down the recovery wells, Cherokee must resample monitoring wells MW3S, MW8M, MW14M, MW15D, MW17M, and MW17D as part of the site-wide sampling program to evaluate groundwater plume migration under static conditions. The Agencies approve the removal of ethanol, methanol and 1,2-trans-dichloroethylene from the analytical parameters list and the elimination of the individual constituent isoconcentration contour maps for the alluvium and shallow bedrock aquifers from the CMI Groundwater Monitoring and Progress Reports.

If you have any questions regarding the approval please do not hesitate to contact me at (215) 814-5467.

Sincerely,

Khai M. Dao
EPA Project Manager

Cc: Jessica Ritenour (PADEP)

Fritz, Jason

Subject: Approval of the revised Field Sampling Report

From: Dao, Khai [mailto:Dao.Khai@epa.gov]
Sent: Tuesday, April 12, 2016 2:23 PM
To: Steely, Jay B
Cc: Ritenour, Jessica L
Subject: Approval of the revised Field Sampling Report

Jay,

EPA and PADEP approve the revisions to the Field Sampling Report submitted by Chester Engineers on March 29, 2016. The revisions will be incorporated to the 2016 groundwater monitoring event. If you have any questions feel free to contact me via email or directly.

Thanks,

Khai M. Dao
EPA Project Manager
USEPA
1650 Arch Street
Mailcode: 3LC30
Philadelphia, PA 19103
Phone: (215) 814-5467
Fax: (215) 814-3113

APPENDICES
APPENDIX B

Landfill Data Analysis

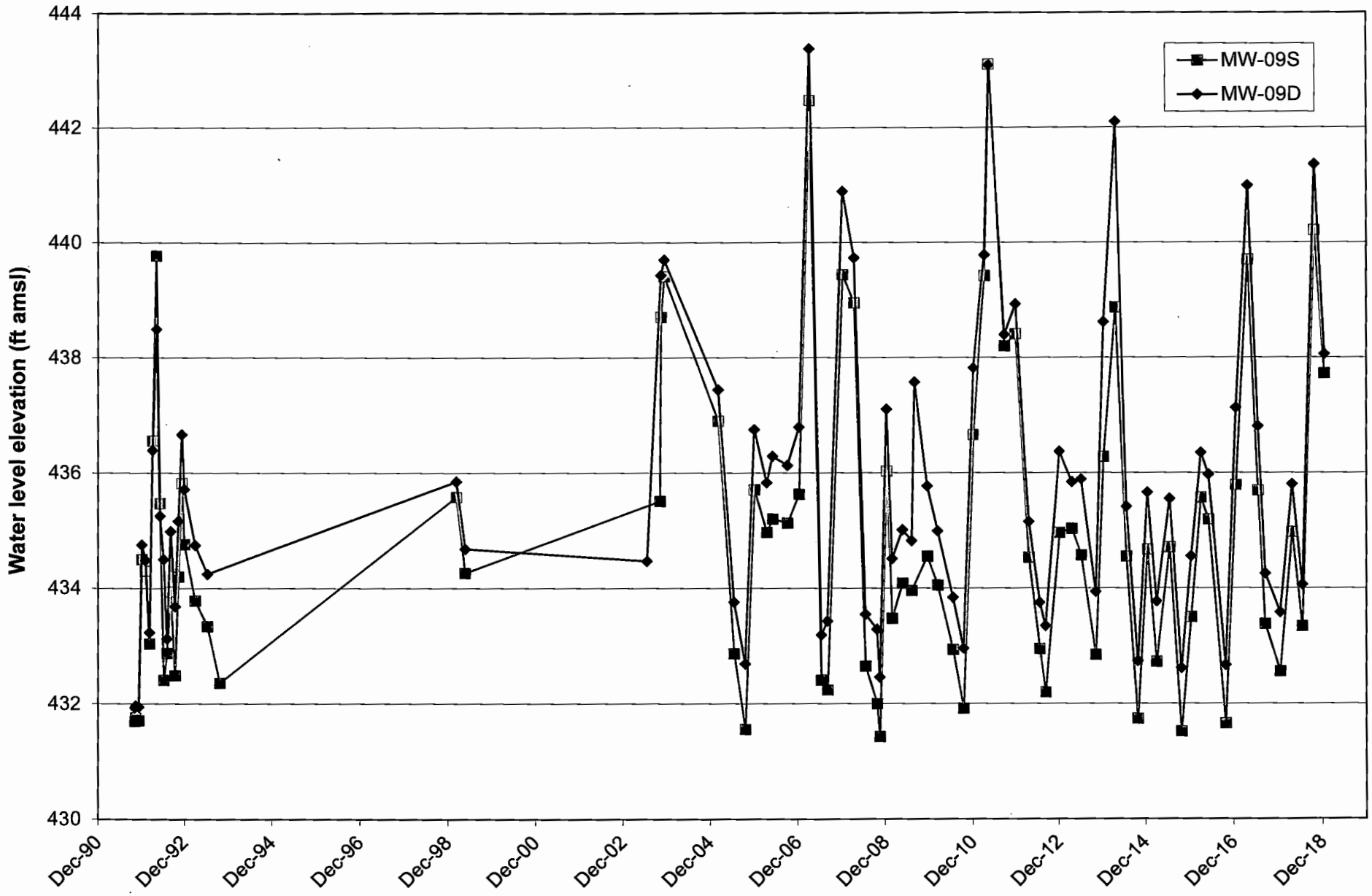


Figure B-1

Historical Water Levels at the MW-09 Well Cluster in the Vicinity of the West End Landfill

Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp

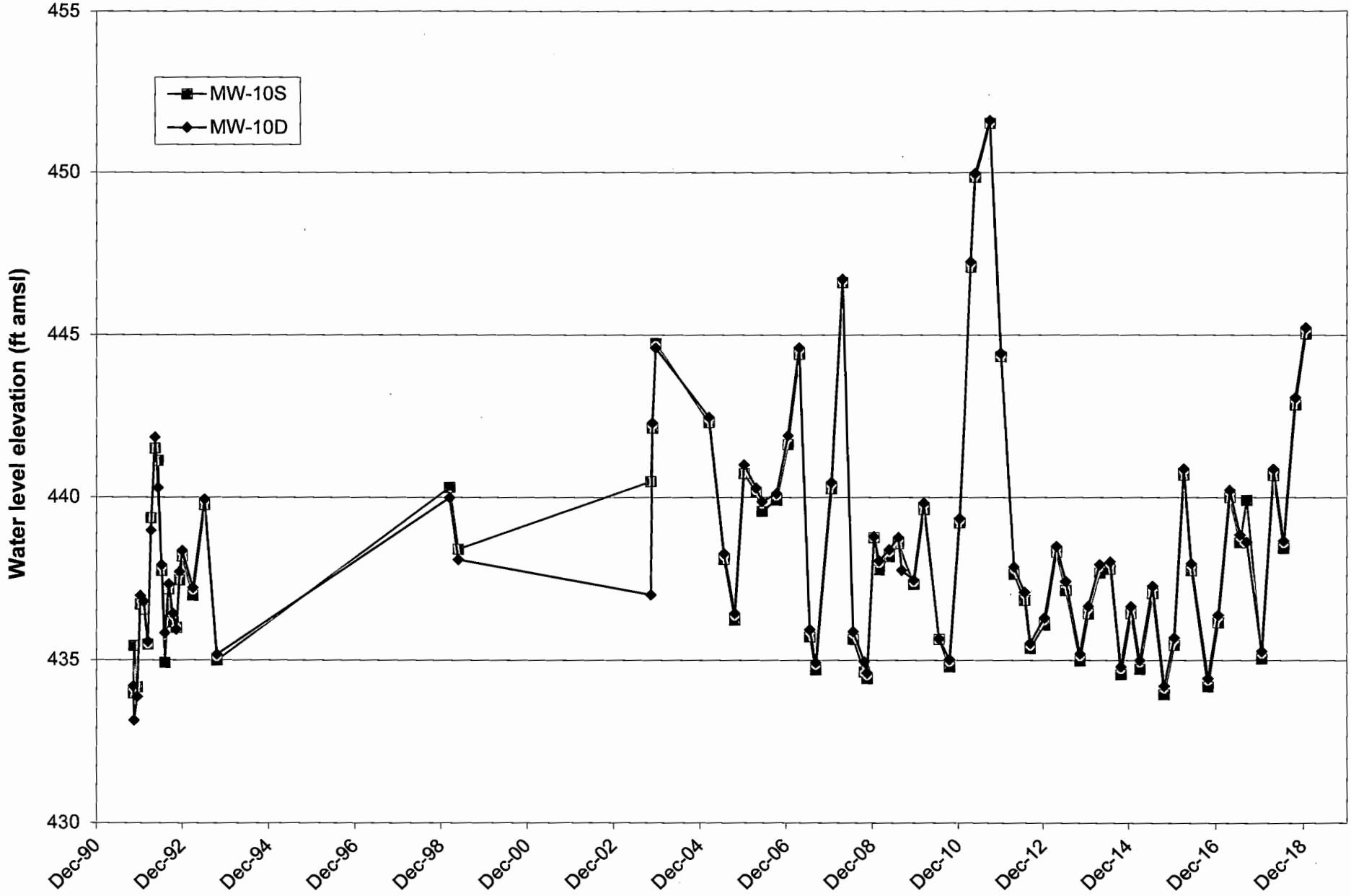


Figure B-2

Historical Water Levels at the MW-10 Well Cluster in the Vicinity of the West End Landfill

Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.

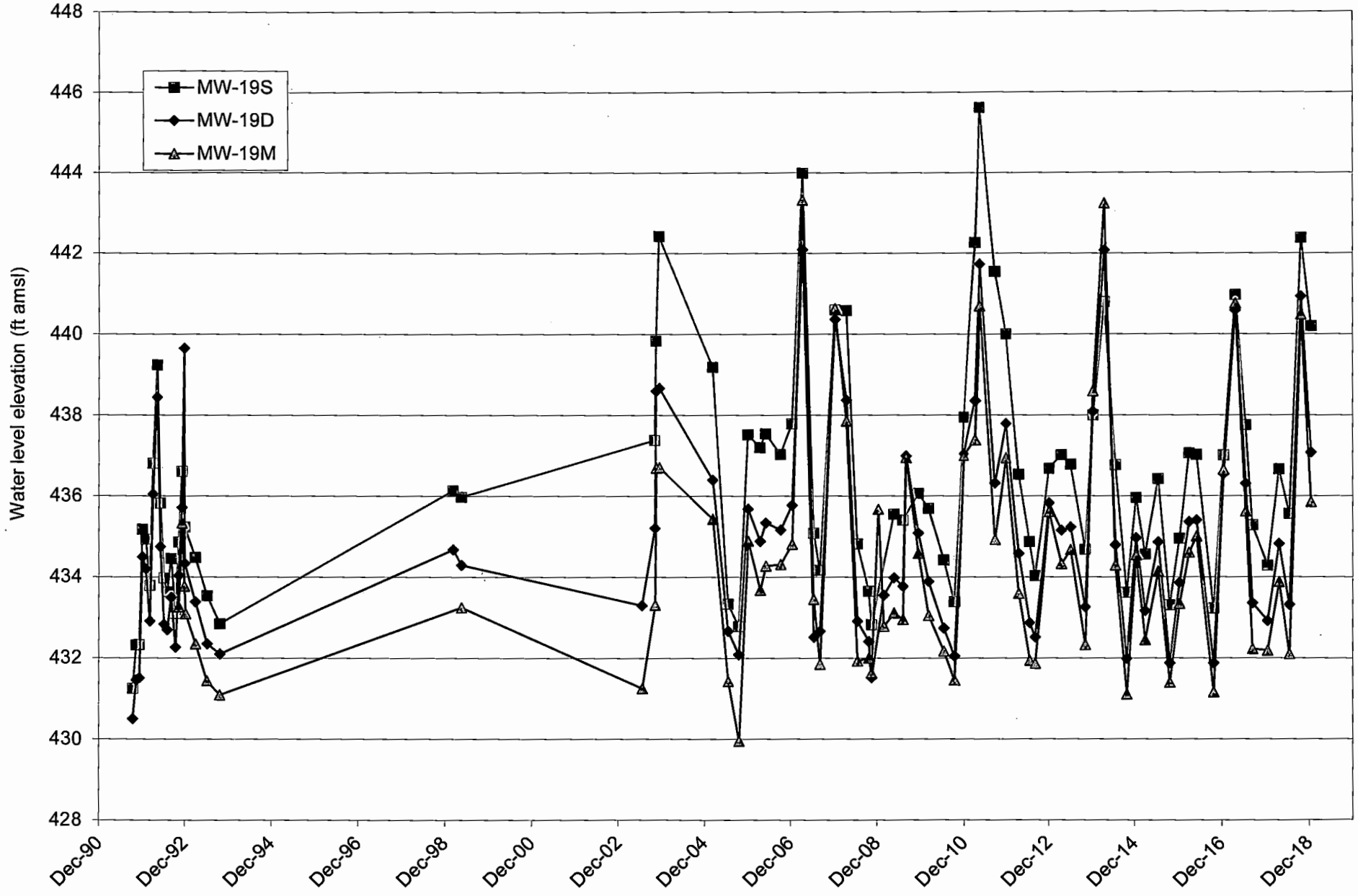


Figure B-3

Historical Water Levels at the MW-19 Well Cluster in the Vicinity of the West End Landfill

Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp

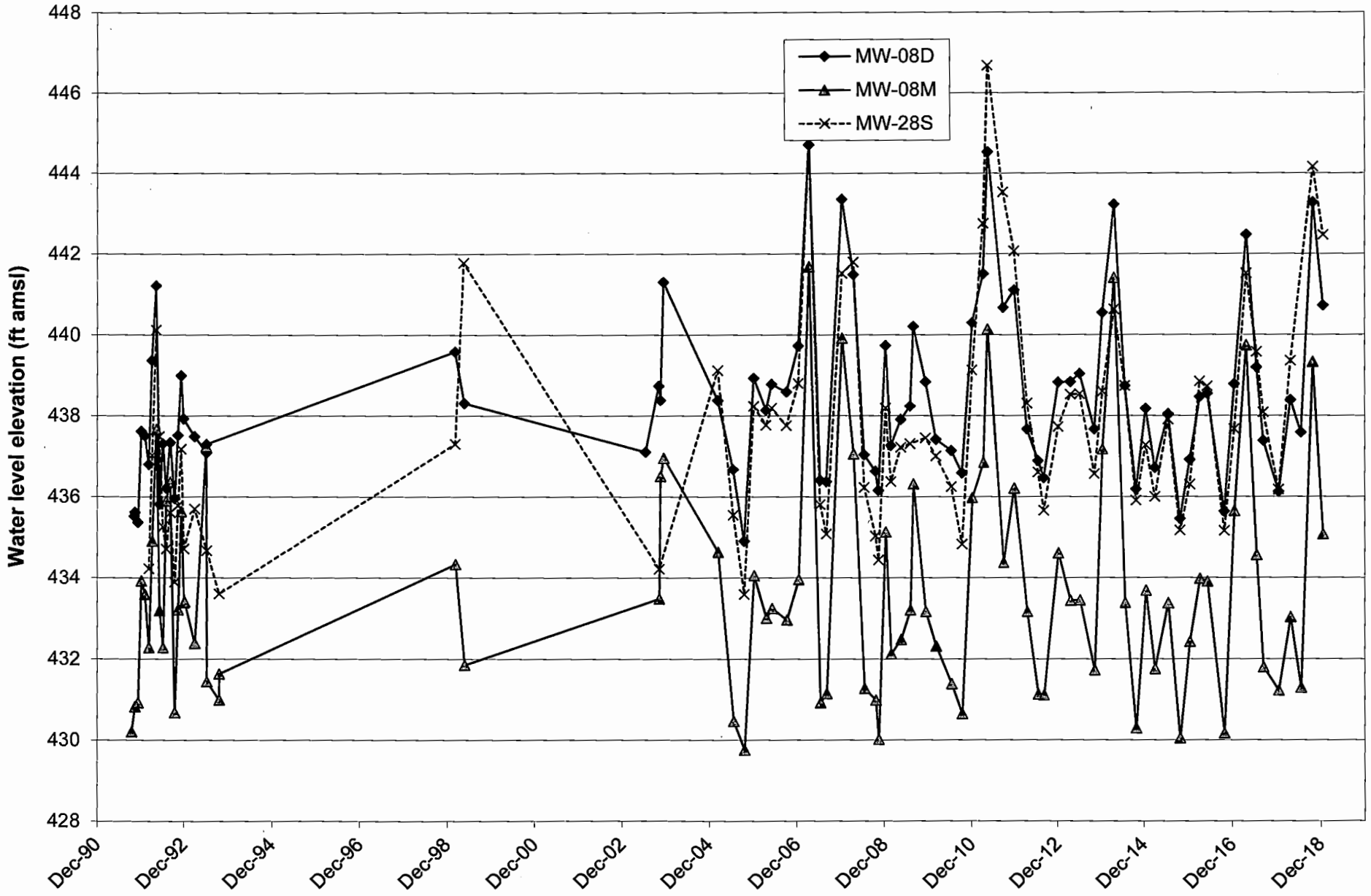


Figure B-4

Historical Water Levels at Wells MW-08D, MW-08M and MW-28S in the Vicinity of the West End Landfill

Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.

TABLE B-1

Historcial Water Level Elevations in the Vicinity of the West End Landfill (ft amsl)
Cherokee Pharmaceuticals, LLC, A Subsidiary of Merck Sharp & Dohme Corp.,
Riverside, Pennsylvania

	Well Name											
Date	MW-08D	MW-08M	MW-08S*	MW-09D	MW-09S	MW-10D	MW-10S	MW-19D	MW-19M	MW-19S	MW-20D	MW-28S
9/23/91								430.50		431.26		
9/25/91		430.21										
10/18/91	435.52		437.86	431.93	431.70	434.21	433.98					
10/24/91	435.62	430.83	436.96	431.96	431.76	433.16	435.44	431.46		432.33		
11/19/91	435.37	430.93	436.86	431.94	431.71	433.88	434.17	431.51		432.34		
12/16/91	437.62	433.93	438.49	434.76	434.50	436.98	436.72	434.50		435.18		
1/15/92	437.51	433.60	438.45	434.49	434.30	436.79	436.56	434.20		434.93		
2/18/92	436.80	432.29	438.18	433.24	433.04	435.57	435.49	432.92		433.79		434.23
3/17/92	439.37	434.91	440.52	436.40	436.56	438.98	439.37	436.05		436.81		437.03
4/23/92	441.22	437.67	442.98	438.50	439.77	441.85	441.51	438.45		439.24		440.12
5/19/92	435.82	433.20	441.01	435.25	435.47	440.30	441.12	434.74		435.83		437.49
6/18/92	437.31	432.29	430.39	434.50	432.41	437.92	437.75	432.84		433.97		435.26
7/16/92	436.22	435.90	439.55	433.13	432.88	435.63	434.93	432.70		433.63		434.71
8/18/92	437.34	436.37	439.81	434.99	433.94	437.33	437.18	433.50		434.45		435.61
9/23/92	435.96	430.69	438.53	433.69	432.49	436.43	436.17	432.27		433.10		433.90
10/21/92	437.52	433.22	439.52	435.17	434.20	435.94	436.00	434.04	433.26	434.86		435.79
11/18/92	436.99	435.64	440.73	436.67	435.82	437.71	437.46	435.72	435.33	436.61		437.18
12/8/92								439.66	433.77			
12/9/92	437.93		440.35	435.72	434.76	438.36	438.20	434.34				
12/10/92		433.39								435.23		434.72
12/17/92		433.41							433.09			
3/9/93				434.75	433.78	437.22	436.99	433.39		434.48		
3/10/93		432.39										435.70
3/11/93	437.49		440.22						432.35			
3/12/93											433.61	
6/14/93									431.44			
6/15/93												
6/16/93		437.25									433.02	
6/17/93	437.09	431.45	440.35		433.34	439.94	439.78	432.36		433.54		434.67
6/18/93	437.30		441.00	434.25								
9/28/93												
9/29/93		431.00			432.36				431.09		432.14	433.61
9/30/93		431.64				435.18	435.00					
10/1/93								432.11		432.85		
2/23/99	439.59	434.34	444.88	435.85	435.58	440.00	440.31	434.67		436.14	434.36	437.31
5/3/99								434.29	433.25	435.98	433.43	
5/4/99					434.26							
5/5/99						438.09	438.40					
5/6/99				434.68								
5/7/99		431.86										441.78
5/10/99	438.31		444.31									
7/1/03	437.11			434.47				433.30	431.26			
10/21/03	438.74	433.49			435.51	437.01	440.49	435.21	433.31	437.38		434.22
11/3/03	438.39	436.51		439.43	438.71	442.29	442.13	438.60	436.70	439.84	438.15	
12/1/03	441.31	436.96		439.70	439.41	444.60	444.74	438.67	436.71	442.43	438.59	
2/24/05	436.38	434.64		437.44	436.90	442.47	442.30	436.40	435.43	439.19	436.18	439.12
6/29/05	436.68	430.47		433.76	432.87	438.27	438.10	432.67	431.43	433.34	432.80	435.55
9/27/05	434.91	429.76		432.69	431.56	436.44	436.24	432.09	429.95	432.79	431.29	433.60
12/19/05	438.93	434.06		436.75	435.71	441.00	440.73	435.68	434.89	437.52	435.58	436.24
3/30/06	438.14	433.01		435.83	434.97	440.29	440.16	434.88	433.68	437.20	434.62	437.77
5/18/06	438.78	433.25		436.29	435.20	439.87	439.57	435.34	434.27	437.54	435.05	438.19
9/19/06	438.59	432.97		436.13	435.13	440.12	439.92	435.16	434.31	437.03	434.95	437.76
12/26/06	439.73	433.96		436.79	435.63	441.90	441.63	435.77	434.81	437.79	435.79	438.80
3/29/07	444.71	441.68		443.38	442.48	444.61	444.41	442.09	443.32	443.99	442.49	444.83
6/25/07	436.41	430.93		433.19	432.41	435.94	435.72	432.52	433.45	435.08	432.06	435.81
8/15/07	436.38	431.15		433.43	432.24	434.93	434.71	432.67	431.85	434.17	432.28	435.08
12/27/07	443.36	439.92		440.89	439.44	440.46	440.27	440.37	440.63	440.60	440.40	441.52
3/31/08	441.49	437.06		439.73	438.95	446.71	446.61	438.37	437.85	440.59	438.46	441.80
6/27/08	437.04	431.28		433.55	432.65	435.86	435.65	432.91	431.93	434.82	432.49	436.23
9/29/08	436.63	430.99		433.29	432.00	434.96	434.64	432.41	432.00	433.65	432.25	435.03
10/22/08	436.16	430.02		432.46	431.43	434.61	434.44	431.52	431.63	432.83	430.85	434.44
12/22/08	439.74	435.13		437.10	436.03	438.80	438.76		435.67		436.12	438.19
2/4/09	437.27	432.13		434.51	433.48	438.05	437.78	433.55	432.78		433.46	436.38
4/30/09	437.91	432.48		435.01	434.09	438.39	438.19	433.98	433.11	435.55	433.82	437.22
7/16/09	438.24	433.21		434.82	433.96	438.77	438.58	433.77	432.95	435.40	434.18	437.31
8/13/09	440.21	436.32		437.57		437.76		436.99	426.95		437.38	
11/23/09	438.84	433.17		435.77	434.55	437.46	437.33	435.08	434.58	436.07	434.92	437.45
2/17/10	437.42	432.32		434.99	434.05	439.83	439.63	433.89	433.05	435.69	433.76	437.01
6/24/10	437.14	431.39		433.84	432.94	435.66	435.65	432.74	432.17	434.42	432.77	436.25
9/20/10	436.59	430.65		432.96	431.92	435.02	434.8	432.05	431.46	433.39	cno	434.83
12/15/10	440.3	435.98		437.82	436.66	439.35	439.22	437.04	437	437.95	cno	439.13
3/28/11	441.51	436.85		439.76	439.42	447.25	447.09	438.35	437.38	442.27	438.56	442.75
5/3/11	444.53	440.14		443.09	443.1	449.98	449.87	441.73	440.69	445.62	441.53	446.66
9/22/11	440.68	434.36		438.40	438.20	451.62	451.53	436.32	434.92	441.55	cno	443.53
12/12/11	441.11	436.21		438.93	438.41	444.44	444.34	437.79	436.94	440.01	437.82	442.07
3/29/12	437.67	433.17		435.15	434.53	437.87	437.65	434.58	433.59	436.54	434.12	438.31
6/28/12	436.89	431.13		433.75	432.95	437.09	436.84	432.67	431.94	434.87	432.59	436.61
8/15/12	436.47	431.11		433.35	432.20	435.53	435.37	432.52	431.87	434.03	432.19	435.66
12/14/12	438.83	434.61		436.37	434.96	436.30	436.09	435.83	435.61	436.68	cno	437.73
3/28/13	438.84	433.44		435.84	435.03	438.50	438.32	435.15	434.32	437.02	434.88	438.53
6/14/13	439.04	433.45		435.89	434.57	437.42	437.15	435.23	434.67	436.78	434.49	438.54
10/14/13	437.67	431.73		433.94	432.85	435.20	434.99	433.26	432.33	434.66	432.87	436.57
12/23/13	440.55	437.18		438.62	436.28	436.66	436.43	438.09	438.59	438.00	437.87	438.60
3/31/14	443.23	441.41		442.1	438.87	437.94	437.68	442.08	443.24	440.8	cno	440.63
6/30/14	438.74	433.39		435.41	434.55	438.02	437.8	434.79	434.29	436.77	cno	438.74
9/30/14	436.19	430.3		432.74	431.74	434.8	434.57	431.99	431.11	433.62	cno	435.91
12/23/14	438.18	433.69		435.66	434.67	436.65	436.44	434.96	434.54	435.96	cno	437.28
3/9/15	436.72	431.76		433.77	432.73	435	434.73	433.17	432.45	434.56	cno	436
6/26/15	438.05	433.38		435.55	434.71	437.27	437.05	434.86	434.14	436.43	cno	437.91
9/30/15	435.46	430.05		432.62	431.52	434.21	433.96	431.88	431.4	433.31	cno	435.17
12/21/15	436.92	432.43		434.55	433.5	435.69	435.47	433.86	433.34	434.95	cno	436.31
3/11/16	438.47	433.98		436.35	435.57	440.89	440.7	435.36	434.6	437.08	cno	438.85
5/12/16	438.55	433.91		435.97	435.19	437.97	437.75	435.4	435	437.02	cno	436.73
9/28/16	435.64	430.17		432.67	431.66	434.45	434.2	431.88	431.16	433.23	cno	435.16
12/22/16	438.79	435.65		437.13	435.79	436.39	436.16	436.55	436.65	437.01	cno	437.68
3/30/17	442.48	439.74		440.99	439.7	440.23	440.01	440.59	440.76	440.97	cno	441.52
6/22/17	439.2	434.56		436.81	435.69	438.85	438.61	436.31	435.62	437.76	cno	439.58
8/17/17	437.39	431.8		434.25	433.38	438.63	439.92	433.36	432.23	435.28	cno	436.09
12/20/17	436.13	431.23		433.58	432.56	435.28	435.05	432.92	432.19	434.28	cno	436.18
3/28/18	438.39	433.03		435.8	434.97	440.88	440.68	434.82	433.88	436.67	cno	439.36
6/21/18	437.59	431.3		434.06	433.34	438.66	438.44	433.32	432.1	435.56	cno	cno
9/27/18	443.28	439.33		441.36	440.21	443.08	442.86	440.94	440.49	442.39	cno	444.16
12/20/18	440.73	435.07		438.06	437.72	445.23	445.04	437.08	435.85	440.21	cno	442.47

MW-08S* was damaged beyond repair and replaced. The new MW-08S is not part of the current monitoring network and has not been resurveyed.
S-series wells are screened in the alluvium, D-series wells are screened in the shallow bedrock, and M-series wells are screened in the intermediate-depth bedrock.
A blank indicates that the water level was not measured or an elevation could not be calculated.
cno = could not obtain.

APPENDICES
APPENDIX C

List of Documents Reviewed

Cherokee Pharmaceuticals, LLC, Chester Engineers, Hatch Chester, and Hatch, Records of recovery well inspection data (spreadsheets).

Cherokee Pharmaceuticals, LLC, Email related to 2018 landfill inspection.

Chester Engineers, Fourth Quarter 2013 CMI Groundwater Monitoring and Progress Report, April 2014.

Chester Engineers, Corrective Measures Implementation Five Year Re-Evaluation Report (October 2008-October 2013), April 2014.

Chester Engineers, First Quarter 2015 CMI Groundwater Monitoring and Progress Report, July 2015.

Chester Engineers, Second Quarter 2016 CMI Groundwater Monitoring and Progress Report, October 2016.

Hatch Chester, Third Quarter 2017 CMI Groundwater Monitoring and Progress Report, January 2018.

Hatch, Fourth Quarter 2018 CMI Groundwater Monitoring and Progress Report, April 2019 (in preparation).

Merck & Co., Inc., Cherokee Site RFI Task Report: RCRA Facility Investigation Final Report, Riverside, Pennsylvania, October 1994.

Merck & Co., Inc., Ecological Assessment, Attachment B of the Cherokee Site RFI Final Report, October 1994.

Merck & Co., Inc., Human Health Risk Assessment, Attachment A of the Cherokee Site RFI Final Report, May 1998 (revised).

Merck & Co., Inc., Merck & Co., Inc., Merck Cherokee Facility Vapor Intrusion Assessment, June 2003 (updated August 2005).

N.A. Water Systems, LLC, Deep Bedrock Hydrogeologic Investigation Report, Merck & Co., Inc., Cherokee Plant, Riverside, Pennsylvania, October 2004.

N.A. Water Systems, LLC, Corrective Measures Implementation (CMI) Report, Cherokee Pharmaceuticals, Riverside, Pennsylvania, August 2008.

Pennsylvania Department of Environmental Protection (PADEP), 2019, Land Recycling Program Technical Guidance Manual, Section IV, Vapor Intrusion, Document Number 261-0300-101, January 2019.

United States Environmental Protection Agency (EPA), 2015, OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154, June 2015.

United States Environmental Protection Agency, Statement of Basis, Merck and Co., Inc., Riverside, Pennsylvania, EPA ID #: PAD 003043353, January 16, 2007.

United States Environmental Protection Agency, Final Decision Response and to Comments Under RCRA Section 3004(u), Merck and Co., Inc., Riverside, Pennsylvania, EPA ID #: PAD 003 043 353, April 25, 2007.

United States Environmental Protection Agency, HSWA Permit Modification, Cherokee Pharmaceuticals, LLC, EPA Identification Number PAD003043353, July 7, 2007.

APPENDICES
APPENDIX D

Risk Assessment Review Results Table

Human Health Risk Assessment Review - Table 3-2
Identification of Constituents of Interest (Soil)[1]
Cherokee Pharmaceuticals, LLC, Riverside, Pennsylvania

Constituent	Detection Range (mg/kg)	March 1994 EPA Region III RBC (mg/kg)	September 2008 EPA Region III RBC (mg/kg)	November 2013 EPA RSL (mg/kg)	November 2018 EPA RSL (mg/kg)	Detection Frequency	Consitutent of Interest (COI)	Rationale for Exclusion
1,2 Dichloroethane	0.001 – 0.430	7	0.45	0.43	0.46	23/150		Max. conc. slightly below to RSL but is well below industrial soil RSL (2.0 mg/kg), which is more appropriate exposure scenario.
1,2-Dichloroethene(c/t)	0.012J - 0.013	780	700	700	160 (cis) / 1,600 (trans)	2/150		Max. conc. below RSL
1,2-Diphenylhydrazine	0.390J - 20.000J	0.8	0.61	0.61	0.68	4/50	X	
1,4-Dichlorobenzene	2.200J - 3.600J	27	2.6	2.4	2.6	2/50		Frequency of detection <5%
2-Chlorophenol	2.200J - 3.100	390	390	390	390	2/50		Max. conc. below RSL
2-Hexanone (MBK)	0.002J - 0.002J	47,000	--	210	200	1/1		Max. conc. below RSL
2-Propanol, 2-Methyl-	0.003J - 1.400	--	--	--	--	4/149		Frequency of detection <5%
4,4'-DDD	0.006J - 0.006J	2.7	2	2	1.9	1/50		Max. conc. below RSL
4,4-DDE	0.015J - 0.015J	1.9	1.4	1.4	2	1/50		Max. conc. below RSL
Acenaphthene	0.140J - 0.250J	4,700	3,400	3,400	3,600	2/50		Max. conc. below RSL
Acenaphthylene	0.044J - 0.084J	880	--	--	--	4/50		Max. conc. Below Region III value[3]
Acetone	0.002B - 60.000B	7,800	61,000	61,000	61,000	138/150		Max. conc. below RSL
Acetonitrile	0.014J - 0.014J	470	870	870	810	1/149		Max. conc. below RSL
Aldrin	0.001J - 0.001J	0.038	0.029	0.029	0.039	1/50		Max. conc. below RSL
Alpha-BHC	0.011J - 0.014J	100	--	0.077	0.086	2/50		Max. conc. below RSL
Anthracene	0.040J - 0.420	23,000	17,000	17,000	18,000	6/50		Max. conc. below RSL
Benzene	0.001J - 34,000	22	1.1	1.1	1.2	32/150	X	
Benzo(a)Anthracene	0.088J - 0.990	0.88	0.15	0.15	1.1	8/49		PNA - eliminated as COI[2]
Benzo(a)Pyrene	0.041J - 0.880	0.088	0.015	0.015	0.11	13/50		PNA - eliminated as COI[2]
Benzo(b)Fluoranthene	0.052J - 1.100	0.88	--	0.015	1.1	13/50		PNA - eliminated as COI[2]
Benzo(g,h,i)Perylene	0.048J - 0.410	2,300	--	--	--	6/50		Max. conc. Below Region III value[3]
Benzo(k)fluoranthene	0.092J - 0.430	8.8	1.5	0.15	11	3/50		PNA - eliminated as COI[2]
Beta-BHC	0.001J - 0.029J	350	--	0.27	0.3	6/50		Max. conc. below RSL
Bis(2-Ethylhexyl)Phthalate	0.047B - 0.160B	46	35	35	39	15/50		Max. conc. below RSL
Bromodichloromethane	0.008J - 0.008J	10	10	0.27	0.29	1/150		Max. conc. below RSL
Carbon Disulfide	0.002J - 0.005	7,800	670	820	770	5/150		Max. conc. below RSL
Chlorobenzene	0.002J - 6100 J	1,600	310	290	280	32/150	X	
Chloroform	**0.001J - 32.000**	**100**	**0.3**	**0.29**	**0.32**	**63/150**	**X**	
Chrysene	0.038J - 0.920	88	15	15	110	15/50		Max. conc. below RSL
Cyanide, Total	0.850 - 5.500	1,600	1600	22	23	6/50		Max. conc. below RSL
Cyclohexane	0.002J - 0.140J	--	7200	7,000	6,500	2/150		Max. conc. below RSL
Delta-BHC	0.018J - 0.041J	--	--	--	--	2/50		Frequency of detection <5%
Di-n-Butyl Phthalate	0.038J - 0.350J	7,800	6,100	6,100	6,300	4/50		Max. conc. below RSL
Dibenz(a,h)Anthracene	0.094J - 0.130J	0.088	0.015	0.015	0.11	2/50		Frequency of detection <5%
Dibromochloromethane	0.006J - 0.006J	7.6	5.8	0.68	8.3	1/150		Max. conc. below RSL
Endosulfan I	0.016 - 0.016J	470	370	370	470	1/50		Max. conc. below RSL
Endrin Aldehyde	0.006J - 0.0006J	--	--	--	--	1/50		Frequency of detection <5%
Ethanol	0.600J - 0.630J	--	--	--	--	2/150		Frequency of detection <5%
Ethyl Acetate	0.002J - 0.160	--	70,000	670	620	4/150		Max. conc. below RSL
Ethyl Ether	0.002J - 0.180	16,000	16,000	16,000	16,000	15/150		Max. conc. below RSL
Ethylbenzene	0.001J - 0.980	7,800	5.7	5.4	5.8	5/150		Max. conc. below RSL
Fluoranthene	0.048J - 2.000	3,100	2,300	2,300	2,400	17/50		Max. conc. below RSL
Indeno(1,2,3-cd)Pyrene	0.055J - 0.330J	0.88	0.15	0.15	1.1	4/50		PNA - eliminated as COI[2]
Methanol	0.660J 3- 8.300	39,000	31,000	120,000	120,000	14/150		Max. conc. below RSL
Methyl Chloride	0.011B - 0.011B	--	1.7	120	110	1/150		Max. conc. below RSL
Methyl Ethyl Ketone	0.002J - 0.045J	47,000	28,000	28,000	27,000	28/149		Max. conc. below RSL
Methylene Chloride	0.001B - 53.000B	85	11	56	57	120/150		Blank contaminant
Naphthalene	0.073J - 0.210J	3,100	3.9	3.6	3.8	4/50		Max. conc. below RSL
Phenol	0.200J - 1.100	47,000	18,000	18,000	19,000	3/50		Max. conc. below RSL
Pyrene	0.043J - 1.600	2,300	1,700	1,700	1,800	16/50		Max. conc. below RSL
Tetrachloroethene	0.003J - 0.003J	12	0.57	22	24	1/150		Max. conc. below RSL
Tetrahydrofuran	0.002J - 1.700	--	--	18,000	18,000	14/150		Max. conc. below RSL
Toluene	0.001J - 170.000J	16,000	5,000	5,000	4,900	44/150		Max. conc. below RSL
Trichloroethene	0.002J - 1.500	58	2.8	0.91	0.94	15/150		Residential RSL incorporates a mutagenic endpoint that is specific to child exposure. Max. conc. well below industrial worker RSL for TCE in soil (6.0 mg/kg), which is more appropriate exposure scenario.
Trichlorofluoromethane	0.001J - 0.260	23,000	800	790	23,000	19/150		Max. conc. below RSL
Vinyl Chloride	0.007J - 0.015	0.34	0.06	0.06	0.059	2/150		Max. conc. below RSL
Xylene	0.001J - 2.000	160,000	600	630	580	7/150		Max. conc. below RSL

Notes:
Bold items identify compounds that were not identified as COIs in 1998 RFI, but are added as COIs due to change in an RBC/RSL.
There were no changes in COIs since the 2014 review.
[1] No new soil data collected related to the CMI. As such these are the same values as presented in 1998 RFI HHRA.
[2] Per the HHRA (1998) PNAs may be eliminated at COIs because they were never used in the Plant's manufacturing process and were never produced by the Plant
[3] No current RSL. Max. conc. below the historical Region III Value.
B indicates that the constituent was detected at a similar concentration in an associated blank.
J indicates that the constituent was detected below the reporting limit and the concentration is estimated.
Screening criteria based on residential exposure scenario.
November 2018 RSLs based on TR=1E-06, HQ=1.

Human Health Risk Assessment Review Table 3-3
Identification of Constituents of Interest (Seeps and Springs)[1]
Cherokee Pharmaceuticals, LLC, Riverside, Pennsylvania

Constituent	Maximum Detection (mg/L)	March 1994 EPA Region III Tap Water RBC (mg/L)	Sept 2008 EPA Region III Tap Water RBC (mg/L)	Nov 2013 EPA Tap Water RSL (mg/L)	Nov 2018 EPA Tap Water RSL (mg/L)	1992 Ambient Water Quality Criteria (mg/L)	2008 Ambient Water Quality Criteria (mg/L)	2013 Ambient Water Quality Criteria (mg/L)	2019 National Recommended Water Quality Criteria (mg/L)	2008 Federal MCLs (mg/L)	2013 Federal MCLs (mg/L)	2019 Federal MCLs (mg/L)	Detection Frequency	Constituent of Interest (COI)	Rationale for Exclusion
1,2-Dichloroethane	0.0025J	0.00012	0.00015	0.00015	0.00017	--	--	0.00038	0.0099	0.005	0.005	0.005	1/15	X	
1,2-Dichloroethylene(c/t)	0.0058	0.0061/0.012	0.33	0.028 (cis) /0.086 (trans) / 0.13 (mixed)	0.036 (cis) /0.36 (trans)	--	--	--- (cis) / 0.14 (trans)	--- (cis) / 0.1 (trans)	.07 (cis) / 0.1 (trans)	0.07 (cis) / 0.1 (trans)	0.07 (cis) / 0.1 (trans)	1/15		Max. conc. below RSL and AWQC (t-1,2-DCE)
Acetone	1.1000B	0.37	22	12	14	--	--	--	--	--	--	--	3/15		Max. conc. below RSL
Benzene	6.1	0.000087	0.00041	0.00039	0.00046	0.0012	0.0022	0.0022	0.00058 - 0.0021	0.005	0.005	0.005	9/15	X	
Chlorobenzene	8.200J	0.0039	0.091	0.072	0.078	0.68	0.13	0.13	0.1	0.1	0.1	0.1	10/15	X	
Chloroform[3]	0.0570J	0.00015	0.00019	0.00019	0.00022	0.0057	0.0057	0.0057	0.06	--	0.08	0.08	4/15	X	
Ethanol	1.7000J	--	--	--	--	--	--	--	--	--	--	--	1/15		Professional Judgment[4]
Ethyl Ether[5]	*2.9*	*0.12*	*7.3*	*3.1*	*3.9*	--	--	--	--	--	--	--	*11/15*		*Max. conc. Below RSL and AWQC*
Ethylbenzene[2]	**0.0420J**	**0.13**	**0.0015**	**0.0013**	**0.0015**	**3.1**	**0.53**	**0.53**	**0.068**	**0.7**	**0.7**	**0.7**	**2/15**	**X**	
Methanol	5.3000B	1.8	18	31	20	--	--	--	--	--	--	--	7/15		Max. conc. below RSL
Methyl Ethyl Ketone	0.0058J	2.2	7.1	4.9	5.6	--	--	--	--	--	--	--	1/15		Max. conc. below RSL
Methyl Isobutyl Ketone	0.0012J	0.18	2	1	6.3	--	--	--	--	--	--	--	15/15		Max. conc. below RSL
Tetrahydrofuran	2.3	--	--	3.2	3.4	--	--	--	--	--	--	--	4/15		Max. conc. below RSL
Toluene	9.6000J	0.075	2.3	0.86	1.1	6.8	1.3	0.86	0.057	1	1	1	4/15	X	
Trichloroethylene[2]	**0.0012J**	**0.0016**	**0.0017**	**0.00044**	**0.00049**	**0.0027**	**0.0025**	**0.0025**	**0.0006**	**0.005**	**0.005**	**0.005**	**2/15**	**X**	

Notes:
[1] No new seep data were collected. As such these are the same values as presented in 1998 RFI HHRA.
[2] Bold items identify compounds that were not identified as COIs in 1998 RFI but are added as COIs due to change in EPA Regional Screening Level (RSL) (Formerly EPA Region III Risk Based Concentration [RBC])
[3] MCL for chloroform based on MCL for total trihalomethanes (TTHMs)
[4] See HHRA (1998)
[5] Italics indicate compounds previously identified as COIs that are below current screening levels and would no longer be a COI
B indicates that the constituent was detected at a similar concentration in an associated blank
J indicates that the constituent was detected below the reporting limit and the concentration is estimated.
November 2018 RSLs based on TR=1E-06, HQ=1.

Human Health Risk Assessment Review - Table 3-4
Identification of Constituents of Interest (River Water)[1]
Cherokee Pharmaceuticals, LLC, Riverside, Pennsylvania

Constituent	Maximum Detection (mg/L)	March 1994 EPA Region III Tap Water RBC (mg/L)	Sept 2008 EPA Region III Tap Water RBC (mg/L)	Nov 2013 EPA Tapwater RSL (mg/L)	Nov 2018 EPA Tap Water RSL (mg/L)	1992 Ambient Water Quality Criteria (mg/L)	2008 Ambient Water Quality Criteria (mg/L)	2013 Ambient Water Quality Criteria (mg/L)	2019 National Recommended Water Quality Criteria (mg/L)	2008 Federal MCLs (mg/L)	2013 Federal MCLs (mg/L)	2019 Federal MCLs (mg/L)	Detection Frequency	Constituent of Interest (COI)	Rationale for Exclusion
Acetone	0.018B	0.37	22	12	14	--	--	--	--	--	--	--	7/9		Max. conc. below RSL
Benzene	0.0018J	0.0001	0.00041	0.00039	0.00046	0.0012	0.0022	0.0022	0.00058 - 0.0021	0.005	0.005	0.005	1/9	X	
Beta-BHC	0.00001B	0.00004	--	0.022	0.000025	0.000014	9.10E-06	9.10E-06	8.00E-06	--	--	--	1/9		Blank contaminant
Bis(2-ethylhexyl)Phthalate	0.011J	0.0048	0.0048	0.0048	0.0056	0.0018	0.0012	0.0012	0.00032	0.006	0.006	--	1/9	X	
Bromoform[3]	0.0020J	0.0024	0.0085	0.0079	0.0033	0.0043	0.0043	0.0043	0.007	--	0.08	0.08	3/9		Max. conc. below RSL and AWQC
Chlorobenzene[2]	*0.0075*	*0.0039*	*0.091*	*0.072*	0.078	*0.68*	*0.13*	*0.13*	0.1	*0.1*	*0.1*	*0.1*	*4/9*		*Max. conc. below RSL and AWQC*
Dibromochloromethane[3]	0.0013J	0.0001	0.0008	0.00015	0.00087	--	0.0004	0.0004	0.0008	0.005	0.08	0.08	1/9	X	
1,2-Dichlorobenzene	0.0014J	0.037	0.6	0.28	0.3	2.7	0.42	0.42	1	0.6	0.6	0.6	1/9		Max. conc. below RSL
Ethanol	2.70B	--	--	--	--	--	--	--	--	--	--	--	7/9		Blank contaminant
Methanol	0.880J	1.8	18	31	20	--	--	--	--	--	--	--	1/9		Max. conc. below RSL
Methoxychlor	0.0001J	0.018	0.18	0.027	0.037	0.1	--	0.1	0.00002	0.04	0.04	0.04	2/9		Max. conc. below RSL and AWQC
Methylene Chloride	0.0013B	0.0041	0.0048	0.0099	0.011	--	0.0046	0.0046	0.02	0.005	0.005	0.005	1/9		Max. conc. below RSL and AWQC
Tetrahydrofuran	0.026	--	--	3.2	3.4	--	--	--	--	--	--	--	5/9		Max. conc. below RSL

Notes:
[1] No new surface water data were collected. As such these are the same values as presented in 1998 RFI HHRA.
[2] Italic items indicate compounds previously identified as COIs that are below current screening levels and would no longer be a constituent of interest
[3] MCL for bromoform and dibromochlormethane based on MCL for total trihalomethanes (TTHMs)
B indicates that the constituent was detected at a similar concentration in an associated blank
J indicates that the constituent was detected below the reporting limit and the concentration is estimated.
November 2018 RSLs based on TR=1E-06, HQ=1.

Human Health Risk Assessment Review - Table 3-5
Identification of Constituents of Interest (River Sediment)[1]
Cherokee Pharmaceuticals, LLC, Riverside, Pennsylvania

Constituent	Maximum Detection (mg/kg)	March 1994 Region III RBC (mg/kg)	September 2008 Region III RBC (mg/kg)	Nov 2013 EPA Residential Soil RSL (mg/kg)	Nov 2018 EPA Residential Soil RSL (mg/kg)	Detection Frequency	Constituent of Interest (COI)	Rationale for Exclusion
Acetone	0.009B	780	61,000	61,000	61,000	1/8		Blank contaminant
Benzene	0.006J	22	1.1	1.1	1.2	1/8		Max. conc. below EPA RSL
Bis(2-ethylhexyl)phthalate	2.4	46	35	35	39	6/8		Max. conc. below Region III value
Chlorobenzene	0.027	160	310	290	280	1/8		Max. conc. below Region III value
Di-n-octyl phthalate	1.2	160	--	610	630	5/8		Max. conc. below Region III value
Ethyl ether	0.002J	1,600	16,000	16,000	16,000	1/8		Max. conc. below Region III value
Methylene chloride	0.005B	85	11	56	57	3/8		Max. conc. below EPA RSL; blank contaminant
Phenolics	14.5	4,700.02	18,000	18,000	19,000	4/8		Max. conc. below EPA RSL for phenol

Notes:
[1]No new sediment data were collected. As such these are the same values as presented in 1998 RFI HHRA.
B indicates that the constituent was detected at a similar concentration in an associated blank
J indicates that the constituent was detected below the reporting limit and the concentration is estimated.
November 2018 RSLs based on TR=1E-06, HQ=1.